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THE PAN-PACIFIC FOOD CONSERVATION CONFERENCE.

The Pan-Pacific Food Conservation Conference at Honolulu in the first half of August was, in many respects, a unique gathering. It was a conference in the very best sense. It was a coming together of scientific men, mainly specialists in branches of agriculture and fisheries, but it was not an occasion for the presentation of research papers. Instead, it was one for comparison and explanation of conditions, for exchange of information and views, and for bringing the best scientific knowledge to bear on subjects relating to the varied food problems of the great Pacific area. Its mission was a practical one; its method was essentially that of the symposium or round table, rather than of a learned society with a formal programme of new technical contributions.

Practically every country in the Pan-Pacific area was represented by one or more delegates. They came from Australia, New Zealand and Fiji, from Japan and Taiwan (Formosa), from China, French Indo-China and Siam, from Java, the Philippines, Mexico, and the United States. Altogether, some twenty countries were represented by upwards of 140 delegates.

The conference was organised in seven sections, prominent among which were Fisheries and Marine Biology, the Sugar Industry, Food Crop Production and Improvement, and Plant Quarantine, the latter including Entomology and plant Pathology. There were also sections on animal industry, food transportation and distribution, and international law and agreements. In the meetings of these sections, to which the afternoon was usually devoted, the detailed discussions were held, while the numerous general sessions in addition to business matters gave

opportunity for the presentation of subjects of broad general interest to the conference, and summaries from the deliberations of the sections.

The social features formed no small part in developing the friendly spirit of the conference. They brought the members together almost daily in pleasant relations with each other and with the local people of various organisations and races, at luncheons, banquets, and typical entertainments arranged for their benefit. These, with the unusually interesting character of the meetings, served to hold the attention and sustain the interest of the delegates through a continuous period of two weeks.

The atmosphere of the various Pacific countries, given by the different races resident in Hawaii who have preserved their native habits and traditions, made an appropriate setting for such a conference. And, what was quite as important, it helped to impress upon the delegates the human aspects of the food question as distinguished from purely those of production, a phase of no small importance as represented by deep-seated habit and the traditions of ages.

In his address opening the conference, Governor Farrington called attention to the steadily growing neighbourly sentiment prevailing among the races and nations of the Pacific, as illustrated by the wide-spread interest and hearty response to the call for the conference, and saw in it not only the determination to live and let live but to help others to live. It was thought appropriate that the first food conservation conference should be held in the Pacific, with the oldest civilisations and the greatest massing of population on the one side, and the greatest undeveloped areas and a development of science never equalled in history on the other. Citing the gigantic growth of production and trade in Pan-Pacific countries within the last ten years, the Governor showed that Hawaii's prosperity rests on the products of its soil which help to feed the world.

The address of Dr. L. O. Howard, of this Department, as chairman of the conference, dealt with the question of the future food supply viewed from the standpoint of increasing population. The world is not yet over-populated, he declared,

and in a strictly biological sense it will never be over-populated by the human species or any other species. He explained that biologically the word "overpopulation" implies something unnatural, something beyond nature's laws, something impossible, since the old principle of the "balance of Nature" may be depended upon to prevail. But in maintaining his position in this balance of nature man must see to it that he retains control over other species, lest he suffer for food. A great advantage of the human species lies in a collective mind and ability for concerted action. Other species represented by thousands of species of insects, for example, are far better adapted to continued existence upon the earth than is the human species. It is the birth of intelligence, the human mind when put to collective use, that places man in control and enables him to assume the commanding place.

Referring to the apprehension for the future food supply unless the present increase in the world's population is checked, Doctor Howard cited the vast opportunities for increasing production, and the enormous losses from insects and plant diseases, losses which can and must be very greatly decreased. Apart from the possibility of introducing birth control to retard overcrowding, he prophesied that the co-operation of the best brains, the pushing of human inventiveness, will result not only in better conserving the world's resources for the benefit of humanity, but in increasing them in ways that are not dreamed about as yet. This was declared to be the controlling idea of the conference.

While food conservation and increased production to meet inevitable requirements was the central topic of the conference, it had many of the aspects of a peace gathering, for a fair division of food among peoples is a measure of peace, and already serious inequalities are being felt. Hence the means of mitigating these deficiencies, often through bringing to bear the results of scientific progress, are steps in the direction of peace. The spirit of informality, of mutual interest, of brotherhood, which was the real heart of the conference, early gave it a deeper significance than that of purely scientific deliberation. Furthermore, a series of popular evening lectures by noted specialists attending the conference was arranged which aroused much interest and attracted large audiences.

A notable feature of the conference was that it concerned itself with large problems, considered from a broad standpoint. In these considerations the international view-point was constantly maintained ; the participation of delegates from so many different countries did not permit it to be lost sight of. This fact compelled thinking in broad and sympathetic terms, and from the stand-point of international relations. In this way the inter-dependence of peoples, always recognised theoretically but lately emphasized by increasing intercourse and communication, gave colour and form to nearly every subject which came up for discussion. The result was a broadening of understanding, and as the days went by the effect became more evident in the discussions.

It is not too much to say that the conference gave such a survey and understanding of conditions of production and consumption in Pan-Pacific countries as has never before been effected. It developed an appreciation of many questions not generally realised, which are becoming of vital importance to their respective localities. It also clarified the reasons for policies and regulations of different countries and showed the obstacles to change.

Many interesting instances were brought out of the factors which have influenced the agriculture of particular sections to make it what it is, such as environment, transportation facilities, traditions, the food habits and the methods of life of the people. Labour conditions have, of course, a large influence in the farm practices followed, and account for the tremendous amount of hand labour frequently involved in tropical agriculture. This is illustrated, for example, by the continued practice in Java, in rice harvesting, of cutting off the heads by hand, favoured by the abundance and cheapness of labour. Many quaint examples of "moon farming" and various superstitions in connection with seeding and other processes were cited.

The fixed character of the diet of certain peoples and the extreme difficulty in changing the food habits has a great influence on the agriculture and on the adequacy of the food supply, preventing the partial substitution of new or unfamiliar materials. Objection to the cutting off of timber discourages

the growing of upland rice, because that crop means the clearing of land which, after a few years, is abandoned and another tract denuded. The factor of transportation is responsible for shortage of food and famine as, for example, in China, where the extension of food production to large available areas and the movement of food supplies is prevented by the lack of modern transportation means.

While the present tendency of progressive agriculture is to take every advantage of favourable environmental conditions, in some instances this has not followed, for reasons cited, with the result that environment continues to dominate the people. They have worked out, in spite of it, systems and practices which are made to suffice under somewhat adverse conditions, and change is difficult to effect. These things, as in other parts of the world, are reflected in the degree of prosperity and development of the farming people. Along with a high degree of adaptability to conditions in certain lines, there has been a lack of adaptability or an adherence to adverse conditions, which in the course of generations has brought about the inevitable results.

Considerations of this sort were disclosed in connection with the discussion of agricultural research and extension, to which one session was devoted. They illustrate some of the handicaps and limitations in that direction. Much appreciation was expressed, however, of the experiment stations as a means of advancement in all parts of the Pacific areas. In all countries represented, such institutions were looked to as a main reliance in improving the practice and developing the efficiency of food production. The increase in the number and support of these agencies was strongly advocated and, in that connection the great advantage of central stations provided with adequate laboratories and trained experts to carry on the advanced lines of research was urged from widely separated quarters.

The importance of an adequate diversification of crops in the Pacific countries was shown, in order to give a greater measure of economic security and to better utilize the varied resources and conditions found in them. This is a matter which has not received adequate attention in some cases, with the result that agriculture has been mainly confined to a limited number of specialized crops, with the resulting effect on the local food supply and on the outlook for the general farmer.

That the increase of food or changes in the type of production need to be undertaken with discrimination was maintained by several speakers. While advocating food conservation and increased production, a warning was sounded against enlarging the production of crops indiscriminately and without foreknowledge as to the effect upon the delicately adjusted agricultural balance. Similarly, the effect of upsetting the types of agricultural production by the introduction of other crops was illustrated by the present rice situation. Rice is the principal food-stuff in the Pacific, from the stand-point of consumption as well as of production and trade. It was estimated to form 50 per cent. of the daily food of some 500,000,000 people. It has been the principal crop of many of the Pacific nations, but there is a growing tendency for rice-using countries to import more and more every year, even among those that have been self-supporting in the past. This is because they have turned from rice culture to export crops, such as tobacco, coffee, tea, sugar, and rubber, yielding larger returns. As a result the rice question in that area is regarded as one of outstanding importance, deserving of close study. The difficulty of substituting other cereals was reported as causing concern for the future supply of the staple food.

The sugar section was one of the most active ones, and its deliberations were followed closely by a considerable group. This was natural from the prominence of this crop in many of the Pacific countries, the highly developed character of the practices relating to its cultivation and manufacture, and the economic questions surrounding it. From a technical standpoint, perhaps no section gave more pronounced results than the sugar section. The fact that the industry is on so large and efficient a scale locally and that a world-reputed experiment station has been provided to promote its advancement lent special interest and opportunity to this branch of the conference. Some of the large plantations and sugar mills were visited, where improved varieties of cane and the latest engineering and factory methods were interesting features.

So also was the opportunity to see thousands of acres in pine-apples, the effect of local environmental conditions on that crop, the successful use of sulphate of iron spray in adapting the crop to manganous soils, a product of the work of the Federal Experiment Station in the Islands, and the extensive pine-apple canneries equipped with the most modern appliances, which turn out a pack of approximately 6,000,000 cases a year.

Some of the special difficulties which have been encountered in the development of agriculture were strikingly illustrated by

examples from Australia. Two pests in particular were mentioned by Sir Joseph Carruthers, heading the delegation from that country. One of these was the prickly-pear, which from a single specimen carried into the country to adorn a garden has spread to an impenetrable cactus maze, covering vast areas and increasing at the rate of a million acres a year. Methods of suppression or reclamation which are economically practicable have not yet been found, although prizes have been offered and many proposals tested. The aid of science in combating this pest is earnestly sought.

More familiar is the rabbit pest, in combating which success has been more promising. In New South Wales alone, 115,000 miles of rabbit proof fences have been erected, at a cost of £6,800,000. A curious fact in the fighting of this pest was the development of a conflict of interest between land-owners who are endeavouring by every means to rid their lands of the pest, and trappers who discovered they could secure such returns from the skins that they opposed extermination. The profits from trapping drew labour from the farms where it was employed in fighting the pest. The industry of exporting skins and meat has grown to about £5,000,000 a year but fencing, digging out, poisoning, and other means are still employed to hold this enemy under control.

The subject of quarantine against plant pests, and the combating of these pests of various kinds, naturally had a large place in the conference. The representatives from this Department pointed out the large factor which these pests constitute in food production, and told of the steps taken to secure adequate inspection laws in the United States. The spread of pests was said to have kept pace with the advancement of transportation. Prompt notification to other countries of the discovery of a new pest was urged This was cited as a type of co-operation which would mean much in preventing the spread of these enemies to agriculture.

A definite product of the conference was embodied in a series of resolutions covering a quite wide range of subjects and expressing the combined view of the conference as to advantageous procedure. These have been published, and in addition it is planned to issue a report of the proceedings, with abstracts of the various papers. Many of the papers will doubtless be printed in full in journals devoted to their special fields. On the whole, the tangible product of this conference of nearly 150 representatives is a highly creditable one and can hardly fail to mark a distinct step, not only in improved understanding but in a knowledge of problems and methods for their solution.—Experiment Station Record, Vol. LXI, No. 5.

TEA

TEA IN THE EMPIRE.

The growth of the tea industry within the Empire during the past century is an example of agricultural and commercial development so rapid and, on the whole, so sound that it probably equals in importance any similar development on record.

The Empire exhibits at Wembley during the summer now ended have drawn attention to many aspects of colonial industry and prominent among them is the tea industry. In this connection there have appeared a number of articles on the subject in such journals as *Empire Production and Export* (July and September), *Imperial Commerce and Affairs* (July) and in the *Tea and Coffee Trade Journal* (August). These articles have been largely drawn on for the information in this article.

In the July number of this Journal an article on Tea in Jamaica referred briefly to the historical interest of the tea plant and to the development within the Empire of the modern industry and specially to the success that has attended a commercial attempt to produce tea in Jamaica.

Up to quite recent times tea was produced commercially almost entirely in China and Japan and at the present time in spite of greatly reduced exports, China is probably the premier tea producing country of the world. Statistics are difficult to prepare in a country like China and particularly for a product which, like tea, enters into the daily use of its enormous population.

China, where tea has been cultivated for a thousand years or more, was originally the only producer and consumer of the products of this plant. In the 13th century, it is said to have been introduced into Japan. About 100 years ago the Dutch established a commercial cultivation of tea in Java. At about the same time the East India Company began to experiment with tea cultivation in Assam and, in 1836, a pound sample was sent to London. In 1840, tea cultivation was started on a commercial basis in India and a few years later in Ceylon. At the present time, India and Ceylon are the principal producers of tea for export in the world. China, Japan, Formosa and the Dutch East Indies, Natal, Nyasaland and other British Colonies following.

India exported 294,700,000 lb. of tea during 1922, and of this 259, 100,000 lb. went to England. Ceylon exported in that year 171,400,000 lb. of which 103,900,000 lb. was imported into England. As will be seen from these figures the United Kingdom is the greatest importer of the teas of India and Ceylon; China, Japan and Formosa teas provide the greater part of the teas consumed in the United States of America.

The tea plant although grown largely in the tropics is apparently a sub-tropical plant. A native of Assam, it has spread far from tropical borders in Japan and China and in Natal, and in South Carolina, it has proved its

ability to withstand the comparative extremes of the American temperate climate. On the whole, however, the great development of the tea industry has been well within the tropics, and it would appear that many tropical localities not yet exploited are suitable for tea cultivation. The requirements as to temperature are not exacting, but the hot steamy atmosphere of Assam appears to be very favourable to the production of quantity and quality. Tea thrives on a variety of soils, but the careful selection of the most suitable soils and regard to manurial requirements of the crop will probably yield very satisfactory results both in the matter of quality of product and the health and longevity of the plants. A moderate to heavy rainfall well distributed, something over 70 inches with 200 or more rainy days in the year, is said to be necessary for best results. The one circumstance which would limit tea production in many parts of the Empire is the labour situation. For the successful cultivation, reaping and manufacture of tea an abundant supply of reliable labour is required. Much of the work can be performed by women and children, and is thus eminently suited to many tropical localities, but in such localities the people are often not sufficiently reliable.

The black and green tea come from the same bush, the difference between them being the results of different processes of manufacture.

The rate of consumption of tea varies greatly, the English speaking people using more tea than those of other races. In the United Kingdom the per capita consumption is put at about 9 lb. per annum. Australians and New Zealanders are also great tea drinkers, and they use about as much as the English people. In Canada the consumption is only about 5 lb. per head per annum.

In one day it is stated that two tons of tea were used in serving drinks in the restaurants of the British Empire Exhibition at Wembley.

America is not a great tea-consuming country but intensive advertising may result in increased consumption and by advertising also the British grown teas may be made to replace China and Japan varieties.

The Ceylon tea industry was built on the collapse of the coffee in that colony. During the '70's coffee was so severely ravaged by the Hemelia or bright leaf disease that the planters were faced with ruin. But the success of tea in India induced Ceylon planters to substitute it for their failing coffee with the result that a cultivation of over 500.000 acres has been developed, with a production which in certain years has gone over 200,000,000 lb.

In Natal, the failure of coffee was followed by a tea development and more recently the tea in this part of South Africa has been to some extent replaced by sugar-cane.

In Nyasaland tea cultivation has passed the experimental stage and in 1922 the imports from this colony into England amounted to 666,560 lb. of tea having a value of £33,080.

In Kenya and Uganda trials are now being made, which give promise of developing into satisfactory commercial propositions. The conditions in Malaya would seem favourable for tea cultivation also.

Information supplied to Kenya by the Director of Agriculture, Ceylon, for the guidance of planters who are making trial of tea cultivation includes

the following:—Tea may give a serviceable yield in 3½ to 4 years from planting according to some authorities and in 6 or 7 years according to others. A good yield is 700 to 900 lb. made tea per acre.

In Assam it is estimated that to bring an estate of 400 acres into bearing, to build the necessary factory and other necessary permanent buildings, to purchase and erect the machinery and to import labour would cost from £80 to £100 per acre. In Ceylon, the cost of the machinery alone on an estate of 200 acres all in full bearing is estimated at £1,000 exclusive of power engines and buildings. Virgin soil is advised for planting tea but many tea gardens have been established on old coffee or flax lands.

The cultivation of tea would appear to be attractive to planters who need to find a new crop in localities where the climate and labour conditions are right for such a development. In the older tea districts where labourers are liable to become disaffected and seek higher pay, the expansion of the industry is likely to be at a much slower rate and in this, and in the prospect of greatly increased consumption in the future lies the safeguard of the planters who are minded to try it.—Tropical Agriculture, Vol. I, No. 12.

SIAMESE TEA.

The Record (July, 1923) English edition, No. 9, P. 16, contains a report on the cultivation of "miang" or Siamese tea, which is of the same species as China and Assam tea viz. *Camellia Thea*. The Siamese tea plant has, however, certain varietal differences which distinguish it from China tea, chief among them being the large size to which it grows, and its larger leaves; it is much more closely related to Assam tea. Whereas the tea plant, subject to intense cultivation, has generally given rise to numbers of varieties, the Siamese tea plant, grown under almost wild conditions, has probably not shown much variation. The plant is found wild over a wide area extending from Upper Assam through Yunnan to Tonkin. In Siam the cultivation of "miang" seems to be wholly confined to the portion of the country north of latitude 18°. In some districts the "miang" is never planted, but when the trees are found in the forest a clearing is made round them. In districts where there are large "miang" gardens, the plant is grown from seed. The only care the trees receive is the cutting of the weeds and undergrowth around them about twice a year. The four recognised seasons for picking are June, August, October and December, and the picker removes about two-thirds of a leaf, leaving the basal portion attached to its stalk. In this way four or five terminal leaves of each twig are picked.

The preparation of "miang" consists of steaming the leaves for two hours, tightly pressing the cooled leaves into a container such as a bamboo joint or basket, and leaving the closed package for about a month, when fermentation is complete and the product is ready for use. The material is employed as a stimulant, being chewed and not used in the form of an infusion. The demand for "miang" exists only in Siam and to a small extent in Burma, and there is never likely to be any extension of the trade. There seems, however, to be no reason why, with proper methods, good tea should not be produced in the "miang" districts, and in almost unlimited quantities.—Bulletin of the Imperial Institute, Vol. XXII, No. 2.

COCONUTS.

DWARF COCONUTS.

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Recently there have been so many enquiries regarding the economic aspects of the cultivation of the so-called dwarf coconut, that the following brief notes compiled from information which was kindly supplied from a few estates and from previous issues of the *Malayan Agricultural Journal* may be found useful.

In the *Agricultural Bulletin*, F.M.S., Vol. VII, No. 3, 1919, the late Mr. W. P. Handover invited attention to the commercial possibilities of the cultivation of the dwarf coconut known locally as the "nyior gading" and showed that the variety must have been imported into Malaya from the Dutch East Indies.

He described the general growth and productive characters of the variety as exemplified by palms up to six years old grown on Sungei Nipah Estate, where 500 acres were planted in 1912 from seed-nuts obtained in the District of Krian, where the dwarf variety has been known to be under cultivation for some 30 years as a popular variety amongst the Banjarese rice planters.

The estimates published at that time were based on only two years of production and were described as conservative.

In the *Malayan Agricultural Journal*, Vol. X, No. 1, 1922, Messrs. Jack and Sands described in detail the chief features of the fruits of the "dwarf" varieties and compared them with those of the "king" coconut of Ceylon and the "coco nino" of the Philippines from which they show decided differences. They pointed out that there were at least three distinct types of the local "dwarf" or "nyior gading" variety, recognisable by the colour of their fruits and grouped as (*a*) apricot, (*b*) green, and (*c*) ivory yellow. On existing plantations these types are intermingled with each other and with ordinary talls and semi-talls though the ivory-yellow type predominates. This admixture of varieties is no doubt due, in part, to the fact that in planting these areas, a very large number of fruits had to be obtained from various sources, and it was not always possible to ascertain definitely whether each fruit had been obtained from a typical dwarf ivory-yellow palm. It is quite evident that natural crossing takes place between the tall and dwarf races, so that the semi-talls, or intermediate forms, which occur, are probably first generation hybrids between the talls and dwarfs At the same time it has been shown that the percentage of seeds which breed true to the fruit colour is very high—as high as 96% in the case of the ivory-yellow variety. The talls may also be hybrids, but they are at present regarded as pure dominants which have segregated out in the 2nd generation of a cross between two races. Only carful breeding experiments

can clear up many of the doubtful points connected with the inheritance of these quantitative and colour characters. The different colour types can readily be selected by the colours of the young leaves of the germinating nuts in the nurseries, and this fact should assist planters very materially in planting out fields so that only the type desired is planted in each field. Not only can colour types be thus separated, but talls and semi-talls can be recognised by the growth characters of the young leaves fairly accurately.

The flowering characters of dwarf are also described by Messrs. Jack and Sands and they show that, in the lowlands of Malaya where growth is so rapid, self-pollination is of very frequent occurrence.

As regards the commercial or yielding characters of the dwarf as compared with the ordinary coconut, the following figures show the averages compiled from several estates under good average conditions.

	Ordinary.	Dwarf.
4th year-numbers of nuts per tree	0	15
5th ,, ,, ,, ,, ,, ,,	5	30
6th ,, ,, ,, ,, ,, ,,	20	55
7th ,, ,, ,, ,, ,, ,,	30	75
8th ,, ,, ,, ,, ,, ,,	40	90
10th ,, ,, ,, ,, ,, ,,	55	100
Number of nuts per pikul (133 lbs.) of copra	260	500
Yield of copra per acre in pikuls after 10 years	9	16
Cost of collection of nuts per 1,000	$ 1·20 cts.	·40 cts.
,, ,, husking ,, ,, ,,	·65 cts.	·50 cts.
Number of trees per acre	48	90
,, ,, nuts ,, ,,	2,500	9,000
Thickness of meat	⅝ inch	½ inch
Average amount of meat per nut	510 grms.	165 grms.
,, ,, ,, copra ,, ,,	240 grms.	125 grms.
Average diameter of nut	5½ inch	4⅓ inch.
,, length ,,	5½ inch	4¼ inch.

It is generally taken for granted that the life of dwarf trees is only about half that of the ordinary variety, though this supposition is only based on the statements of Banjarese and other cultivators.

Dwarf trees, still bearing quite well though over 30 years old, can be seen occasionally in different parts of the country, but there is no plantation of dwarfs old enough yet to guide opinions, though there seems no reason why they should not produce for at least 30 years under good estate cultivation.

It is, as yet, unknown which type of dwarf is the most productive of copra though the ivory-yellow type is the most popular possibly only because its bright colour attracts the eye more than the duller red and green types do. Theoretically, the green type should be the hardiest and strongest growing type because of the abundance of chlorophyll contained in its leaf tissue, and the growth of young palms certainly bears out the theory in practice, though it still remains to be proved whether the green and apricot-red types can compare favourably with the ivory-yellow type from the view

point of yield of nuts or copra per tree. The green fruits are usually bigger than those of the ivory-yellow type. It has been suggested that dwarf palms are more susceptible to "spikemoth" attack, but this may only be an environmental effect and, in any case, the disease can be controlled.

Dwarf trees may also be used for the production of toddy, though it is said that the yield per flowering spike falls short by about one-third as compared with tall trees. At the same time, dwarf trees usually produce spikes in more rapid succession than tall trees and also they begin to produce spikes some 3-4 years earlier. Another consideration is that the spikes of dwarf trees, in being situated much nearer the ground, are easier to tap, though the cooly has to tap more spikes to get the same amount of liquid as he gets from spikes of tall trees, and therefore prefers to deal with tall rather than dwarf trees. It is said that Tamils prefer toddy from dwarf to that from ordinary trees, the beverage being sweeter in the former case.

The information contained in this note is purely of a general nature, yet it is hoped that it will supply some of the information which is often requested by those interested in coconut cultivation.—Malayan Agricultural Journal, Vol. XII No. II.

COCONUT INDUSTRY IN SOUTHERN MEXICO.

One of the most important industries along the coastal sections of the Southern States of Mexico is the production of coconuts. The growth of this tree is natural to the soil and climate of the region, and when coconut groves are once started they need very little care.

In order to lay out a coconut plantation it is necessary to have sandy loamy soil, lying in the vicinity of the seacoast. The first bearing of the coconut trees takes place during the fifth year and full bearing is reached during the sixth year. Groves situated some distance from the seacoast do not bear until the ninth or tenth year. The trees then bear for about 50 years, and after this period of production the yield gradually decreases.

From a report by the United States Vice-Consul at Manzanillo it appears that there are at present in that district about 60,000 coconut trees in full bearing, and approximately 40,000 more trees that will bear within the next three or four years. It is estimated by the Manager of one of the large haciendas in the State of Colima that the annual production of all the trees in the State of Colima is approximately 2,500,000 to 3,000,000 nuts.

Of the annual production, fully 90 per cent. is consumed as a fruit and only a small percentage is used for the manufacture of copra. The majority of the nuts used as fruit are sold to the markets Guadalajara and Mexico City.

When the nuts are to be used in the manufacture of copra, they are left to mature and drop from the trees. The nuts are then split open and are left to dry in the sun for seven or eight days. Following the drying process the meat is then removed from the shell. It takes about seven nuts to make a kilo of dried copra (about 2 2 pounds). The dried copra yields about 50 per cent. oil, which is used chiefly in the manufacture of soap and other toilet articles.

At present the coconut oil is being used in the manufacture of butter substitutes, other edible fats and toilet articles, the use of which is gradually increasing in importance, and which would naturally tend to make this industry one of the most important, agriculturally, in the coastal sections of Southern Mexico.—India Scientific Agriculturist, Vol. V, No. 5.

TOBACCO.

TOBACCO CULTIVATION FOR NICOTINE.

Being a Resume of a Paper* by Cutler and Theron, Assistant Chemists, School of Agriculture, Potchefstroom, and Oosthuizen, late Assistant Chief of the Division of Tobacco and Cotton.

The increasing demand for nicotine products—tobacco extracts, etc.—for use as dips and sprays has caused attention to be directed to the production of tobacco solely on account of the nicotine it contains, and there now exists a local demand for tobacco bearing a high percentage of this content. Various papers † have been published in the *Journal* dealing with the nicotine content of tobacco with special reference to the utilisation of waste and to the growing of tobaccos high in nicotine. Among the former are the papers by Smit and Juritz, whereas the latter phase has been dealt with by Koch, Oosthuizen, and Juritz, who called attention to the possibility of the exploitation of the species *Nicotiana rustica* because of the high percentage nicotine in its leaves normally. The writers heard rumours of good profits being realised by growers of *Nicotiana rustica*, and wishing to ascertain the accuracy of these, they investigated the potentialities of the species as a source of nicotine.

The Yields Obtainable

Definite and accurate information regarding yields is very meagre. Oosthuizen obtained yields of 1,880 to 2,600 lb. per acre of the dried plant. The writers estimated that yields varying from 3,600 lb. to 7,400 lb. of dried plants are obtainable per acre, the plants being set one foot apart in the row and the rows three feet apart. They consider that yields of from one to four thousand pounds of air-dry material should be obtained per acre on reasonably fertile soils and under normal conditions of rainfall stand, etc. The yields obtained by local growers indicate that the stand is poor or that the growth is very small compared to that obtained under the conditions described in the bulletin.

Investigation of Nicotine and Dry Matter Contents.

Since the nicotine occurs for the greater part in the leaf and only in minor quantities in the stem, root, and flowering parts, it is necessary to ascertain what is the amount present in the various parts of the plant and in what proportions these are to each other. Again, since tobacco is bought not on the basis of its green weight, but on the basis of the nicotine present in the dried plant, it is necessary to know what is the amount of loss in weight entailed by drying.

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* Bulletin No. 2, 1924, "Tobacco Cultivation for Nicotine" obtainable from the Editor

† "Tobacco Cultivation for Nicotine," Journal Dept. of Agriculture, February, 1923 (6d.). "Tobacco Soils and Fertilisers Experiments," Reprint No. 58, 1923; price 3*d*. "*Nicotiana rustica* as a Possible Source of Tobacco Extract," Reprint No. 66, 1923; obtainable from the Editor (prepaid).

Moisture and Dry Matter.—It was found that the mature plants contained from 40 to 50 per cent. of leaf, from 30 to 40 per cent. of stalk, and from 13 to 30 per cent. of the reproductive part of the plant in the shape of pods, flowers and their stems. When dried in the air the green plants lost from 82 to 88 per cent. of moisture. In other words, the air-dried plants weighed from 13 to 18 per cent. of the green plants.

Nicotine.—Although the nicotine content of the leaf is high, the stalk and pods contain very little of it, and these two latter occupy so large a proportion of the weight of the plant that the nicotine content of the whole plant is very low in relation to that of the leaf alone. The nicotine content of the entire plant varied from 1½ to 4½ per cent., the latter being the maximum. That in the leaf, at the time when the former was at its maximum, was from 5½ to 8 per cent. The stem contained from seven-tenths to one per cent., the contents of the pods being similar. These are results of analyses of tobacco obtained from various parts of the Transvaal and Cape Province, and may be taken to be representative. It was found that, as the plant matured, the nicotine increased until a maximum was reached. This stage can be determined by pressing a fold of the leaf between the finger and the thumb when a sharp crack will result. The immature leaf is more pliable and does not break readily. This point is coincident with the setting of the seed, and from this stage onwards there is a rapid falling off of the nicotine in the leaf. The time at which the nicotine is at its maximum in the plant is also the time when there is a maximum return of nicotine per acre.

TOPPING

Since the falling off of the nicotine is coincident with the setting of the seed, it might well be assumed that, by topping the plant, the nicotine will be increased. This was found to be so. Topping has a three-fold action; it prevents the plant from utilising the nicotine in the leaf for the formation of seeds; it increases the nicotine content of the plant by inducing it to send out new shoots; and it prevents decomposition of nicotine in the leaf during curing or drying. In order to obtain the maximum of nicotine per acre the plant should be topped as thoroughly as possible during growth, and should be cut at the stage when the maximum of nicotine is present.

RATOONING

N. rustica has a tendency to ratoon, provided there are a few green leaves or a shoot left on the base of the plants when the latter are cut. There is no reason why a second or third cutting should not be obtained if the length of the growing season permits, as it was found that there was no reduction in the percentage of nicotine in the subsequent growths. The profits from the second and third cutting should therefore compare very favourably with that of the first.

CURING

Oosthuizen found that the different methods of curing gave rise to differences in the amounts of nicotine in the final products. The plant is able to utilise the nicotine stored up in its system to supply energy for its metabolism when for any reason the food supply runs low, as in the case of cutting. In other words, the plant continues growth of the flowers, etc., and goes on forming seed after it is cut and hung up to dry; at the same time the nicotine is reduced.

To ensure that there is no loss of nicotine in the curing it is necessary to use means which will at once stop the process of growth in the cut plant which is so persistent in its efforts of flowering and seeding after cutting. Of the various methods of curing, viz , sun-drying, air-drying, green-sweating and air-drying, flue-curing, the two latter are best for this purpose, but on account of the expense of flue-curing, green sweating and air-drying are to be recommended.

FERTILISATION

In a series of experiments the application of nitrogenous manures seemed to hasten maturity and slightly increase the nicotine content of the plant. Topping increased the green weight per acre and also the nicotine content of the leaf, and consequently the weight of nicotine per acre. In a second series of experiments involving the application of complete fertilisers, the increase in yield per acre, nicotine in the plant and nicotine per acre was much more strongly marked.

The writers do not feel justified in recommending this crop (*N. rustica*) on account of the fact that, unless there is it least one ratoon crop obtained, the value of the crop on account of the low yield is not likely to be equal to that of *N. tabacum* on which the same cultural attention has been bestowed.—Journal of the Department of Agriculture, Union of South Africa, Vol. IX, No. 5.

TOBACCO CULTIVATION IN SHANTUNG.

Cigarettes tobacco was first cultivated in Shantung in small quantities in 1915 by the farmers at Fangtze, to whom the British American Tobacco Company distributed seeds for the purpose. A growing demand for this tobacco has extended the planting not only in Fangtze, but also in the neighbouring districts of Ankieu, Changyi and Changlo.

Tobacco of the American variety is preferred by the Shantung farmers for its superior quality. The seeds are sown early in April and the leaves are gathered in September. The average yield of each mow is estimated at 200 pounds. From a report of the Chinese Government Bureau of Economic information, it appears that there are now about 200,000 mow planted in tobacco.

After harvesting, the leaves are treated to a process of curing in specially constructed curing barns before they are sold. The British-American Tobacco Company, the Nanyang Brothers Tobacco Company and Japanese tobacco companies are principal buyers. The local market is most active in October and the months immediately following.

Tobacco leaves are sold by the farmers to the exporters at forty cents per pound and the net profits realised by the Shantung farmers from their annual tobacco crop is fixed at so much per unit size curing barn. These barns are classified into three grades according to their capacity, and the duty is fixed on the scale of $ 12, $ 10, and $ 8 per barn.—Indian Scientific Agriculturist, Vol. V, No, 6.

COTTON.

THE SUPPLY OF COTTON SEED FOR PLANTING PURPOSES.

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The rapid development of the cotton-growing industry in South Africa brings into prominence the question of seed supply; it is therefore expedient at this time to examine existing conditions and to consider how improvements can be brought about to meet the ever increasing demand for good seed. We are in the fortunate position of being able to learn from the experience of other countries and to adopt systems modified to suit our conditions which will be of inestimable help in the maintenance of good supplies of superior seed. In this discussion it is intended to present a few points concerning the seed question, which may be of some assistance in this direction.

The methods of improving agricultural crops may be grouped as follows :—(*a*) Soil fertility and its maintenance ; (*b*) crop rotation ; (*c*) the control of plant diseases and insect pests ; (*d*) the tillage of the soil ; and (*e*) the use of good seed. All of these are dependent on each other, and must be observed and put into practice in good farming. The maintenance of a highly productive soil without the use of good seed to make the best use of such a soil is poor practice, and moreover may turn the balance from profit to loss. In the same way, the use of good seed on land of low productivity or land poorly handled will lead to the harvesting of small crops. When one considers the expenses connected with the various farming operations in the production of a crop such as interest on land, cost of implements, cost of ploughing, cultivation, and fertilizers, and compares these with a relatively small amount invested for seed, it is evident that it should be the best obtainable.

The essential requirements of good seed will differ according to the variety, but in general they are :—Trueness to varietal name ; suitability to the conditions under which it is grown ; no mixing or crossing with other varieties or strains of the same crop; the crop produced must be of good quality; and resistance to disease and general hardiness. This much as far as the suitability of the variety is concerned. The seed itself should conform to the following essentials :—Maturity and plumpness; vitality, which may be lost through disease, age, bad handling, bad storage; freedom from seeds of other crops and from weed seeds; and uniformity. From these definitions it is clear that to produce seed of this standard is no easy matter, and requires technical skill and extreme care. Referring to cotton seed in particular, special conditions and problems present themselves, and it is only by understanding these that a system of seed control can be satisfactorily established.

The staple product of the cotton crops is the lint, the price of which is determined by grade. What spinners require most is uniformity in the lint they purchase. In order to secure the confidence of cotton buyers, cotton of uniform grade, character, and staple must be supplied in quantity. To accomplish this the combined efforts of farmer, cotton grader, and cotton breeder are essential. The present system of compulsory grading in this country has already gained a reputation for South African cotton on the European cotton markets; it now rests with the cotton farmer and his neighbour to grow as uniform a crop as possible and of good quality. To this end he must use good seed and confine his attention to only one variety which has proved itself to be suitable for that area. The growing of only one variety in a locality or even in a wide area is of great importance, as will be seen from the following discussion.

Cotton crosses (hybridizes) very readily. Should more than one variety, therefore, be grown in close proximity, they will commence to hybridize, and the uniformity of each will be lost. This is most marked when an Egyptian cotton crosses with an American-Upland, as their plant characters differ so widely that hybrids are easily recognized. Such hybrids again split up into a large number of divergent forms in the second generation of the cross and, if left in the field, will deteriorate rapidly, ultimately having to be discarded as "run out." Adjacent varieties will cross to the extent of 6 to 10 per cent. and even more in some cases; as the pollen of the flowers is carried mainly by bees, it is evident that, to prevent or minimize crossing, a distance of at least a mile should be allowed between two varieties. Further, most of the cotton of a community is likely to be ginned at the same gin, and however many precautions are taken, it is always possible, when two or more varieties are handled, that seed mixing will take place. Where small gins are established this may not be so serious, as they can be cleaned out more or less completely; but with the larger type of gin, where the seed is conveyed by the screw or pneumatic method, it is impossible to prevent mixing. This means that seed run through a commercial gin cannot be considered true to its varietal name, unless it is the only variety handled. Again, if a number of farmers have cotton of their own choice set apart for ginning separately, it creates an unnecessary expense by delaying regular ginning and having to clean out the gin thoroughly before each parcel passes through. Nevertheless, under our present conditions it is essential that small selected parcels should be treated in this way. In the more modern gins seeds from one bale may be found mixed with the seed from the third bale following. This can be overcome somewhat by first cleaning out the seed-roll and then shutting off the seed conveyors and collecting the seed directly under the gin. Even then some seeds will remain hidden in different parts of the machine and cause subsequent mixing.

It very often happens, too, that a special selection or variety of cotton will lose its identity during handling. It may be wrongly labelled, may be run together with other cottons, or may lose its label altogether. This leads to the loss of improved seed, an improbable occurrence if only one improved strain were being handled by the ginnery. The planting of a cotton field to a variety differing from the one grown the previous year may also lead to

the new variety becoming crossed with the "volunteer" crop of the previous year's variety and to the mixing of the seed of the two varieties. With all these precautions to consider it must be evident to the cotton grower that a "one variety area" is essential for the maintenance of purity in the cotton crop.

Numerous benefits are derived from such a system. The cotton crop requires constant improvement, and perhaps changes in the type of cotton grown may become necessary to meet the demands of spinners. For these reasons the services of a fully qualified cotton breeder are required in order to maintain and improve any particular variety or strain. As only one variety can be successfully bred at any one breeding farm, it follows that it will be to the advantage of the cotton growers of that area to plant the cotton which is being improved. The expense of breeding is such that it cannot be undertaken by individual growers; the work is difficult, painstaking, and requires time. One of the world's most prominent cotton breeders has said: "To put on the market an appreciable quantity of any pedigree cotton seed requires at least five years from the time cotton selection work is started, and the constant service during that period of a technical plant breeder."

Once a pure improved strain of cotton has been produced, it should be propagated and distributed in such a way as to be of most service to the cotton farmers of the area served by the breeding-station. The efficiency of the method of distributing this seed and of keeping it pure will depend a great deal on the farmers themselves and on their whole-hearted co-operation and support of the undertaking. The persistence of a few in endeavouring to select and propagate their own variety will mar the efforts of the community as a whole. Not only would such a "one variety area" have the benefit of a supply of pure seed, but it would undoubtedly mean better returns for the farmers growing the improved cotton. The lint produced will be more nearly of the same grade and character, and will thus command the higher prices paid for "even running" lots of bales. A large and reliable supply of cotton of similar quality will soon bring the area producing it a good reputation and a ready market. In the case of large companies cultivating large areas of cotton this problem is not so acute, as probably only one variety will be grown and seed selection will no doubt be carried out. In a good many instances these companies would have their own gins in operation so that the gin mixing of varieties should not occur.

The benefits to be derived from one variety cotton areas may be summarized as follows:—(1) There would be no mixing of varieties through crossing in the field. (2) The danger of mixing seed at the gin would be minimized. (3) The mixing of lint of different lengths, quality, and character in the same bale would be reduced. (4) The bales of cotton produced would be more nearly of the same grade and would receive more favourable recognition. (5) By employing scientific methods of selection and production the chances of procuring improved seed would be enhanced. (6) Good seed would be less liable to deteriorate than in a "mixed variety area." Taking the foregoing as a basis to work on, the next consideration is the methods that should be adopted to ensure supplies of good cotton

seed. Assuming that small supplies of pure seed are coming from the breeder, they must be propagated carefully in order to produce larger quantities for more general distribution. Naturally, great care should be taken of the seed from the time it leaves the hands of the breeder in order to ensure that it shall not become lost through mixing, incorrect labelling, bad storage, or improper propagation methods. It has been demonstrated that an improved variety or strain cannot be successfully distributed by seeding out small parcels of the improved seed to a number of farmers, as it is very difficult to keep a record of such seed once it has left the hands of the producer, and much of it eventually becomes lost. This may be the result of bad methods of cultivation, mixing with other varieties in the field, or in handling, be due to carelessness or lack of sufficient knowledge on the part of the farmer. Improved seed is too expensive an article to be treated in this way, and once this is realized by farmers they will agree that some system of controlled propagation of their improved seed supplies is desirable.

Where the machinery of co-operation is already working, difficulties entailed in seed multiplication and distribution are largely reduced. It is necessary for the members to agree to the use of the same strain of seed and to have all their seed from one source. The work of seed multiplication might be delegated to one or more members chosen for their experience, reliability, carefulness, knowledge of cotton-growing, and the suitability of their farms for raising a good crop of cotton. The small supply of improved seed available would be handed over to these farmers to be propagated for distribution the following year, and there would be a definite understanding that no other cotton would be planted on these farms to avoid all chance of mixing. Careful methods of cultivation and rogueing (pulling out of inferior plants) would have to be resorted to. Even in the best of fields a few off-type plants are likely to be found. They should be discarded as soon as possible, preferably just before the flowering stage, if their inferiority can be detected then. Others will be eliminated when some of the lint has ripened and subjected to examination. It would be more difficult to successfully serve areas that do not grow cotton under co-operative methods with good seed; still, much benefit would result if such farmers would agree to purchase all their seed from one or more reliable farmers, who would be in charge of special seed farms.

Once a system of seed multiplication and distribution has been decided on, it will be necessary to keep a record of the seed handled by a system of registration. Such registration should be in the hands of the co-operative society or other association established for the purpose, or under Government control. Seed so produced by the breeder for distribution should be covered by a certificate of registration, and each parcel labelled as "pedigree seed" or "stock seed." The certificate should state, besides the varietal name, the name of the breeding farm, the locality where the seed was produced, the number of pounds of seed, the average staple length, the year of origin, and should bear a ginner's declaration of clean ginning.

The "pedigree" seed should in its turn be distributed to a few farms selected as seed farms, and there grown under supervision. The crop should be inspected in the field by recognized cotton experts for uniformity

and trueness to type, and also for the purpose of seeing that the pulling out of inferior plants is carried out properly. During the picking season the farms should again be visited to determine whether the lint produced is of uniform length and quality. When the seed cotton has passed these tests it should be conveyed to the gin for special ginning under supervision in a thoroughly cleaned out machine to ensure that no mixing has occurred. Seed satisfactorily passed in this way should be registered and a certificate issued containing the following particulars :—Variety or strain ; name of grower ; locality of production ; year of production ; number of generations from stock or pedigree seed ; number of pounds of seed ; average length of lint ; it should also bear a ginner's declaration that the seed was kept pure during the ginning operations. Each bag of seed should be labelled as registered seed, and farmers should agree to purchase it in preference to ordinary "gin run" seed, which has been mixed during ginning operations and cannot be guaranteed as pure seed.

A farmer purchasing such seed should have enough for planting all his fields, and only the particular strain should be grown. In cases where the supply of seed is not sufficient for all the planting, some or all of it should be sown in an "increase" field, separated from the general crop of cotton to minimize the risk of contamination through crossing. This field should receive special treatment, all off-type plants being weeded out, and the seed harvested used for planting the main crop the following year. Where large supplies of seed are in urgent demand, it may be necessary to extend the certification to include seed two generations away from the original stock seed, but in all cases the inspection tests must be passed. By adopting a system as outlined above, a constant supply of seed would be available from the breeder for the farmer, and a constant improvement would result.

An idea, quite prevalent, is that once an improved strain of cotton has been produced and distributed, there is no further need for breeding or selection ; that henceforth the farmer can propagate his seed for future crops of cotton from the good seed he has obtained. It has, however, been proved over and over again that this is not the case ; it is only through constant renewal of seed periodically that good qualities can be maintained and improvement brought about. It may not be economically possible for a farmer to buy new improved seed from a seed farm every year. In such a case it is advisable to keep a few acres of the best cotton apart from the rest of the fields as an "increase" plot. The plants not true to type can be easily weeded out and the cotton kept uniform and of high quality. In general, however, this practice cannot be kept up long, as off-type plants are bound to appear and eventually bring down the value of the seed.

Until some efficient system of seed control and seed distribution has been worked out for the South African cotton growers, it is advised that farmers who cannot get pure seed should make the best of the seed they have at their disposal. Cotton seed of a mixed nature will produce some plants which are superior to others in desirable characters, and once the farmer recognizes these, he can pick them out from their neighbours and propagate them separately for seed. This is what is known as mass selection, and although it is not the best method of improving cotton, it is of great value, and will tend to produce greater uniformity. By this means a

large number of plants are selected in the field, taking a certain type as standard, embodying productivity linked with good quality. The number of plants chosen must be calculated according to the number of acres of cotton it is intended to plant two seasons later, reckoning that it takes the seed of about 100 plants to plant an acre, and that an acre will yield about 400 pounds of seed. An increase field from mass selected seed should be carefully examined to discover weak plants, which should be weeded out. By hand-planting the seed from selected plants and placing from three to five seeds at a distance of from one to one and a half feet in the row, a large area can be planted with a limited quantity of seed.

The production of cotton in the Union is increasing., and should the country's output reach, say, a quarter of a million bales in ten years, it would mean that the supply of seed for planting purposes alone would be about 200,000 bags of 100 pounds each. All of this seed must be produced from the seed we have in the country at present, as we cannot think of improving improved seed from other countries. The foundation of our future seed supply is being laid now, and it should be laid well. We should conserve all our improved seed and propagate it by the best methods possible ; for this purpose the support of all cotton growers is required. Thus only can we hope to build up a permanent, high-grade cotton industry : one that shall be regarded with confidence and favour by the cotton buyers of Great Britain and the Continent.—Journal of the Department of Agriculture, Union of South Africa, Vol. IX, No. 4.

IMPROVEMENT IN THE QUALITY OF COTTON

The following extract is taken from the Report of the Department of Agriculture, Tanganyika Territory, for the Year 1923-24:—

In 1921, the Department, which had then just begun, inherited the deteriorated seed which was found in the country at the close of the war. In 1922 an introduction of fresh seed was made from Uganda and a further introduction was made for the 1923 sowings. The districts chosen were, in 1922, Mwanza (in the north-west), and in 1923 Morogoro (central) and Lindi (in the south), and the object was to spread the fresh strain of seed from these points until the whole territory was covered. The old stocks of native-grown seed were eliminated from these districts and the greatest care was taken to ensure the separate ginning of native and non-native cotton. In the 1924 sowing season (February-March) the only parts of the Territory which had not received the fresh seed were the district of Kilwa, the western portion of the Rufiji District and the small-producing districts on the Tanga railway. The native sowings in these have been less than one-tenth of the total native sowings in the Territory. As yet, the fresh seed has not been available for all non-native growers, it being possible only to supply all planters in the Lindi District and 120 tons to planters in the Morogoro and Dar es Salaam Districts, but the supplies from the 1924 crop will be more than sufficient to permit the total elimination of old seed In respect of the introduction into Mwanza and Shinyanga, the report of the Imperial Institute on the eight samples of seed-cotton sent for examination states that these are superior to those sent in previous years (from the old seed). The strength is described as good in all cases except one, which is noted as fairly good. The avearge length of staple was 1-2 inches and the uniformity in length was superior to that of previous years. The Imperial Institute's report on the Morogoro and Lindi cottons is not yet available, but it is possible to give the brokers'

reports (with which the Department has been favoured by local buyers) of consignments to Liverpool of first quality cotton grown by natives from seed of the Uganda importation sown in these two districts in 1923. These are as follows:—

Source	No. of Bales	Report
Kilosa	88	White colour, very clean, staple 1¼ in.
Do	37	Nice white cotton, strong, 1¼ in. staple.
Do	31	Nice clean cotton, strong, 13/16 in., regular
Do	23	Choice creamy cotton, even running, excellent grade, though small amount of seed and strain, staple strong, 1 3/16 to 1 5/16 in. some 1½ in.
Morogoro	10	Beautiful clean cotton, 1¼ in., strong staple,
Do	26	Nice clean cotton, staple 1⅛ to 1 3/16 in.,, slightly irregular.
Do	19	Beautiful clean cotton, 11 in., strong staple.
Tuliani	4	Choice creamy cotton, even running, excellent grade, though small amount of seed and strain, staple strong, 1 3/16 to 1 5/16 in., some 1½ in.
Lindi	74	Very nice lot, staple good, 1 3/16 in.
Do	100	Choice creamy cotton, even running, excellent grade, containing a little leaf, Staple 1 3/16 in., strong.

The special selection work of the Cotton Specialist at the Mpanganya Cotton Station in the Rufiji District reached a further stage in 1923 when, as a result of the examination of the progeny of the single plants chosen in 1922, thirteen selections, each representing the produce of a single plant, were sown. As a result, the purity of these unit strains was not definitely established, though the standard of purity of certain of them was found to be not inferior to that of American varieties received from the United States Department of Agriculture and sown in the same season for purposes of comparison. The selections finally chosen for expert examination in England, with a view to growing some or all of them in 1924, and the data on which the choice of these was based, are as follows:—

Strain	Mean of variation of four variants	Length of Lint and coefficient of variation		Lint index and coefficient of variation	
	%	mm.	%	gm.	%
M.	5·28	27·3	(2·90)	4·30	(8·08)
H.	6·00	26·1	(4·22)	4·44	(6·02)
D.	6·30	27·9	(3·76)	4·20	(10·10)
J.	8·06	27·6	(4·56)	4·04	(13·00)
N.	8·80	29·5	(6·20)	3·72	(13·60)
Mean of all selections	8·2	26·3	(5·81)	4·07	(11·10)

During 1923, the Cotton Specialist selected a large number of plants at different points in the Morogoro District and the produce of these was collected separately. Selections from among these plants, after a careful examination of the produce, will be grown in 1924, and the process and basis of future selections will be the same as has been described for those at the Mpanganya Station. The Cotton Specialist has also assisted the Department in the examination of local samples and in the preparation of instructions to District Agricultural Officers for field selection of cotton types.

OILS

THE ESSENTIAL OIL INDUSTRY IN SEYCHELLES.

The following extract is taken from the Annual Report of the Department of Agriculture, Seychelles, for the year 1923.

The following is a tabulated return showing exports of essential oils during the year :—

Cinnamon bark	14,005	litres
Cinnamon leaf	284,512	,,
Clove leaf	1,136	,,
Basilic	106	,,
Lemon grass	222	,,
Patchouli	591	,,

Cinnamon leaf oil is the article which is still produced on a greater scale than the other oils. Great progress has been made in the methods of distillation and in the treatment of plantations which are now clean weeded. A few planters have adopted the system of stripping the leaves by hand instead of pruning the bushes every year. Several strippings have already been done successfully on some estates ; but it has become evident lately that stripping cannot continue for a long time and that it has to be followed by pruning at periodical intervals, say every 2 to 4 years, to prevent the bushes from giving smaller leaves. Stripping can however in some cases be done nearly every 6 months while pruning takes a longer time (12 months) to give a crop. Planters are therefore justified in stripping and pruning alternatively. By pruning there are many twigs which are left with the leaves at the time of cropping and as the oil obtained from twigs is lighter and more valuable than leaf oil the two oils are sometimes separated and sold independently, although distilled at the same time. By stripping less weight per day's work is obtained than by pruning and the leaves being deprived of the twigs are packed more closely in the stills ; thus higher yields of oil are obtained per "*cuite*" when leaves are stripped. Each method has its supporters and detractors but the majority of planters have this year been in favour of stripping.

Clove oil has been produced on a small scale. This tree grows slowly in the poor laterite soils of the Colony and it will never be planted extensively. When the tree is pruned it does not put forth new growth as easily as cinnamon.

A little quantity of patchouli oil has been exported during the year. A few planters are becoming experts in the fermentation (2 days) and distillation of the leaves of this plant. The wet and warm climate of this colony allows it to be grown in the shade of coconut palms and bananas even near the sea and prevents it from flowering. The bushes become very thick after some time and produce abundant crops. The system of planting

patchouli as an intercalary crop between coconut palms helps to ameliorate the conditions of growth of the coconut palms themselves which have so long been neglected in the past. Distillery refuse, ash, cattle manure are spread all over the field and holes dug for patchouli at 18 inches distance between the coconut palms which are 20-25 feet apart. Thus the coconut plantations are cleaned and manured. As it is the first time that coconut palms are treated in this way they show much better growth than formerly and they give more abundant crops. The yield per acre of patchouli (4 crops) per annum is 1,400 kilos of green leaves, or 200 kilos dry leaves or 8 to 10 litres of oil. *Ocimum viride* oil has not proved a success owing probably to the competition of synthetic thymol. This plant which grew up to 6 to 8 feet high even in poor soil is being abandoned and gradually replaced by another *Ocimum* from which basil oil is manufactured. This is *Ocimum basilicum* of which there are two varieties growing in the colony, one with purple inflorescences and purplish leaves and the other introduced from France by Mr. E. Boulle with greenish-white inflorescences and pale-green leaves. The distillation of these two plants is not advanced enough to show which is the better. There is a marked difference between the smell of the leaves and their habit of growth, the purple variety being more hardy. They are unfortunately both attacked by the caterpillar of a moth of which specimens have been sent home for identification. It is a yellow moth which is very likely indigenous and which seems to be more abundant during the rainy season. By making plantations when the caterpillars are less abundant and eventually by treating attacked plants by lead arsenate, the culture of *Ocimum basilicum* will very likely emerge from the experimental stage. The purple variety has long been established in the colony and its seeds are used by Indians and turned into a refreshing drink. A pinch of seeds is simply poured into a glassful of water which assumes after a few minutes a mucilaginous consistency owing to an extraordinary swelling of the seeds themselves. The plant is called locally *Toc Maria*. The yield of the purple variety is much higher and amounts to 3 kilos per ton of green leaves while the oil from the green variety is reddish brown in colour.

An attempt to introduce *Cymbopogon Martini* from India has been successful and the two varieties of this plant are now established in many gardens of the Colony. This perfume plant which produces palmarosa oil seems of much poorer growth than other citronella and lemon grasses. It will have to be cultivated in the same way as patchouli and it will not likely withstand competition of other more powerful weeds if the latter are left unchecked. It should not be forgotten that much difference exists between the cost price of an oil obtained from a wild tree such as cinnamon and that of a herbaceous plant which has to be grown in a garden. The yield of palmarosa oil reaches 1 % of the raw material, flowers and leaves, in India and if this high yield is obtained in Seychelles it will go far to compensate for the poor growth of the grass.

LIVE STOCK

UDDER DISEASES OF DAIRY COWS.

The following extract is taken from the Farmers' Bulletin No. 1422 on "Udder Diseases of Dairy Cows" by Hubert Bunyea, Veterinary Inspector, Pathological Division, Bureau of Animal Industry of the United States Department of Agriculture.

INFLAMMATION OF THE UDDER (MAMMITIS, MASTITIS, GARGET).

By far the most important disease of the udder is that known as mammitis, mastitis, garget, or inflammation of the udder. The disease assumes three forms, namely, catarrhal, parenchymatous, and interstitial. The first attacks the mucous lining of the udder, the second the milk-secreting structures, and the last the frame work of the udder. These differ in some of their characteristics, and in an individual case all may appear at various stages of the disease.

Causes.—Inflammation of the udder may be due to any cause or combination of causes, such as exposure to cold or wet weather, sudden change of temperature, blows, kicks, bruises, or abrasions of the udder, an injudicious allowance of rich feed, the retention of milk, in frequent or irregular milking, the introduction of contaminated instruments into the udder, local infection, indigestion, or any serious disturbance of the animal's health.

The disease sometimes appears in a mild form which soon passes off, to recur at more or less regular intervals. Although the condition usually occurs about calving time there is no part of the milking period in which it may not appear.

Symptoms.—In different forms or stages of the disease there may be a variation in the symptoms. The usual ones are general depression and discomfiture. There is sometimes chill, but it may escape notice. Among the most conspicuous symptoms are a rough coat, dull eyes, loss of appetite, suspended rumination, and possibly constipation. The animal stands in an awkward, straddling position, and moves about or lies down with reluctance and great difficulty, owing to the soreness of the udder, which will usually be found to be hot and tense, very hard and tender. The fever, though sometimes local, is more likely to be general. A dropsical condition under the skin of the abdomen is sometimes observed.

The secretion of milk is partly or entirely suspended. The milk itself is lumpy or stringy, or its consistency may be altered to that of a serous fluid containing yellowish clots, caused by the coagulation and separation of the casein. The secretion may even become purulent and offensive. Severe inflammation of the udder may also bring about a rupturing of some of the capillaries, which makes the milk bloody.

Recovery may be slow or rapid, complete or incomplete. When the disease passes into a chronic stage there is small likelihood of complete

restoration of function Among the unfavourable results of the chronic condition are hardening of some of the udder tissues, abscess formation, milk fistula, and gangrene of the udder.

Treatment.—Chill, if observed, may be treated by the administration of large quantities of warm drinking water, or of cordial drenches or by hot bathing, or the use of hot blankets.

To reduce fever, give 1 ounce of spirits of nitrous ether three times daily. A full dose of Epsom salt (1 to 2 pounds) may be given at the onset of the disease, to be followed by daily doses of saltpetre, 1 ounce, and bisulphite of soda, 2 drams, in 1 quart of water, as a drench.

The udder should be completely emptied every two hours if possible, using extreme gentleness in the operation, especially if there are blood tinges in the milk. The presence of blood indicates a rupture of some capillaries. If the udder is very tender, it may be necessary to use a sterile milking tube so as to empty the organ with the least pain.

Twice daily, after milking, the udder should be bathed for about 20 minutes with water as hot as the hand can bear, and meanwhile the attendant should continue gently but firmly to massage the udder in a downward direction. All material brought down into the milk cistern by this manipulation should then be thoroughly stripped out, after which the udder should be dried and anointed with warm camphorated oil or an ointment composed of the fluid extracts of belladonna and phytolacca, 1 part each, and lard or lanolin, 8 parts. An excellent ointment may be prepared after the following formula:

Petrolatum	...	...	2 pounds
Spirits of camphor	...	...	2 ounces
Spirits of turpentine	...	...	2 ounces
Oil of peppermint	...	...	½ ounce
Carbolic acid	...	...	½ ounce
Powdered extract of Belladonna leaves			6 ounces

This is to be mixed thoroughly and applied with massage daily after bathing the udder with warm water. The ointment may be rubbed in thoroughly and the udder should be supported by a dry suspensory bandage having holes cut in the lower part for the teats. The udder may be irrigated daily by means of a sterile milking tube attached to a sterile fountain syringe containing a 1 per cent solution of table salt* or a 4 per cent. solution of borax, or boric acid, sterilized by boiling and cooled to blood heat. The irrigating fluid may then be milked out with further massage.

In infectious mammitis beneficial results have been reported from the administration of one-half ounce of sodium salicylate and 2 drams of boric acid in 1 quart of water morning and night as a drench, and one-half to 1 ounce of formalin in 1 quart of milk or oil at noon for several days Very frequent milking is also here recommended.

At every stage of the treatment of infectious mammitis a mild but effective antiseptic solution should be applied to the udder and adjacent parts of the affected cow, and also to the hands of the milkers and to the udders of other animals likely to be exposed in any way to the infection.

* A 1 per cent. solution of common salt in boiled water at body temperature makes a suitable irrigating fluid. A heaping table-spoonful of dry salt weighs approximately 1 ounce and this amount in 1 gallon gives proper strength.

Affected animals should be separated from the herd, and hand-milked last, or, better, by a separate attendant. They should be maintained under sanitary conditions in dry, comfortable quarters, with frequent change of clean bedding, and other attentions given in the proper care of sick animals. The ration should be regulated so as to include a sufficient allowance of nutritious roughage, such as clover, alfalfa, cowpea hay, and to reduce the concentrate ingredients, such as corn meal, cotton seed meal, linseed meal, gluten, and middlings. Clean drinking water should be accessible at all times and should be slightly warmed in cold weather. A moderate amount of bodily exercise is beneficial provided it is taken voluntarily by the cow. Compulsory exercise may be positively detrimental as well as painful to the animal.

INDURATION, OR HARDENING OF THE UDDER.

Probably the most common of the results of mammitis or inflammation, is induration, or hardening of the udder. This condition is due to structural changes in the udder tissue. During mammitis the secreting portion of the udder is in a diseased and wasting condition and the inflammation present appears to establish an increase of the connective-tissue cells which go to make up the supporting framework of the organ. The result is likely to be a large, ill-shaped and pendulous udder. In a well-established case of induration the milk secretion is usually very greatly diminished for that period. Sometimes the secretory function is permanently lost, or decreased to such extent that the animal no longer will be profitable in a dairy herd.

Treatment.—Treatment consists mainly in prolonged hot bathing of the udder twice daily after milking, accompanied by gentle rubbing of the parts affected. After drying the udder thoroughly; apply an ointment composed of lanolin or lard into which has been incorporated 2 per cent. of iodin.

A rich diet, or one likely to stimulate milk secretion, should be avoided until inflammation has subsided, after which time the animal should be brought by degrees to a full, milk-producing ration. Maintain throughout a rather laxative condition of the bowels by an occasional dose of Epsom salt (about 1 pound).

ABSCESS OF THE UDDER.

Abscess is also one of the possible results of infectious mammitis, and is due to infection of the organ by pus-producing germs. The abscess may work toward the surface of the udder, where it can be assisted to a head and lanced by the veterinarian, or it may be ruptured internally and discharge its creamy, liquid pus through the teat. In the event of both external and internal rupturing of an abscess of the udder, there is danger of establishing a milk fistula.

Treatment.—The abscess may be hastened to a head by hot fomentations or poultices. It is then ready to be opened and drained. The after-treatment usually consists of simple cleanliness in the general care of the animal and the dressing of the part twice daily with a watery solution containing 5 per cent. each of glycerin and phenol.

GANGRENE OF THE UDDER.

Gangrene is caused by a serious interference with the blood circulation, as in some cases where the inflammatory swelling or distention with milk is so great as to produce intense pressure on the blood vessels of this region.

The resulting slow, necrotic process causes the death and sloughing off of the affected quarter or quarters. This condition sometimes leads to fatal consequences, due to blood poisoning.

Treatment.—The raw surface should be thoroughly and frequently sponged with some good antiseptic, such as a one-half per cent. solution of chloride of zinc. If amputation of the gangrenous area becomes necessary it should be undertaken only by one skilled in surgical procedure.

TUBERCULOSIS OF THE UDDER.

Usually tuberculous infection of the udder may be distinguished from other udder infections by its gradual onset and chronic course, as well as the fact that it rarely occasions the animal any pain or inconvenience. Tuberculosis of the udder usually commences well up in one or both rear quarters, and may involve the lymph glands situated above and back of the two rear quarters of the udder. The organ itself becomes progressively hard and swollen, sometimes acquiring enormous size. Milk secretion appears normal until the infection has progressed considerably, when the milk becomes thin, watery and scanty, and contains flaky and stringy material, and possibly blood and pus.

This disease, however, may go on unrecognized for years; meanwhile the animal continues to yield milk containing tubercle bacilli, thus endangering the health of other live-stock as well as human lives. In case of mammitis that is considered possibly of tuberculous origin, it is advisable to isolate the individual and have the tuberculin test applied at once.

There is no known cure for this disease. In the diagnosis of tuberculosis of the udder no single method is completely satisfactory. The tuberculin test may be relied upon to demonstrate the presence of the disease in the animal, but it is impossible by this means to detect the location of the infection. If a physical examination of the udder corroborates the positive tuberculin reaction, added significance may be attributed to the suspicion of udder tuberculosis. Finally, milk samples from suspected udders may be submitted to a bacteriological laboratory for examination.

Actinomycosis of the udder, caused by the same organism as lumpy jaw, is not so common as tuberculosis, but is sometimes mistaken for it. Definite diagnosis requires a bacteriological examination.

COWPOX.

Cowpox is an acute, contagious disease, accompanied by a slight fever and a typical eruption which is usually confined to the teats and udder of the cow. The lesions first appear as small, red papules, or nodules, which later resemble blisters and are filled with a clear fluid. The third or pustular stage is marked by the change in the character of this fluid to a pus-like appearance and consistency. The fourth stage is that of drying or desiccation of the pustules.

This disease is usually spread by the hands of the milker and may break out on the cow about seven days after exposure. Cowpox is so mild and so lacking in serious consequences that in many herds its presence is either totally ignored or at least is taken for granted. Nevertheless the presence of the sores on the udders and teats renders milking somewhat painful

to the cow. To avoid aggravating and prolonging the condition, therefore, the operation of milking should be accomplished with great gentleness, and may be facilitated by the use of the milking tube. The milk should be discarded.

Treatment.—The animal so affected should be isolated and milked last, with usual antiseptic precautions to protect the hands of the milker from the infection. Twice daily the affected area should be bathed with a 3 per cent. solution of granular hyposulphite of soda. Once every day or two the pustules may be touched with tincture of iodin or a 5 per cent. solution of silver nitrate.

CHAPPED TEATS.

Chapped teats are caused by any irritation, such as sudden chilling after the sucking of the calf, "wet milking" by the attendant, damp or filthy conditions in the stable, wet bedding, overstocking, exposure of tender skin to sun rays in summer, or freezing in winter, etc. The skin is first rough and inclined to scale, and later wrinkles are formed, which become hard and deep and presently break into raw fissures.

Treatment.—Favourable conditions, such as dry quarters and bedding, cleanliness of the udder, and "dry milking", should be assured. Some reliable antiseptic wash may be used, after which the chapped surface should be painted (once daily) with compound tincture of benzoin or a mixture of 1 part of tincture of iodin and 4 parts of glycerin. It may be advisable to anoint the teats with petrolatum before milking, and to use a sterile milking tube so that the milk may be drawn with the least pain to the animal.

WARTS.

Warts on the teats and udder form an annoying disfigurement as well as an obstacle to milking. While perhaps harmless themselves, they may lead to abrasions or fissures, thus exposing the skin of the animal to the invasion of blowflies or infections.

Treatment.—Long warts may be removed by twisting or tying a silk thread tightly about the base of the growth. The wart will eventually slough off.

Repeated applications of glacial acetic acid or other caustic to the body of the wart have been successfully used in the removal of such growths. Care must be observed, however, to restrict this treatment to the objectionable growth, as these chemicals are very injurious to healthy skin. As a precaution, the normal area around each wart may be previously coated with petrolatum or tallow. A safer treatment is to paint the warts with collodion containing 15 per cent. of salicylic acid. The collodion film is removed every 3 days and the growth is recoated until it finally sloughs off. The simple application of castor oil, at two-day intervals, is also said to be effective in killing warts.

Some warts require surgery for their removal. In such cases the after-treatment consists in painting the wound once or twice daily with tincture of iodin until well healed.

TUMOURS.

Tumors in the teat or milk cistern may be harmless growths or simple connective-tissue enlargements due to interstitial mammitis or to a degeneration of the gland accompanying age. As a rule these growths are better not interfered with unless they become so large as to obstruct the milk flow or otherwise inconvenience the cow. Sometimes they may be reduced by the persistent external application of the tincture of iodin or an iodin ointment. If their surgical removal becomes necessary it should be undertaken only by one skilled in the principles of veterinary surgery, and not until the cow has been dried off. Under the most favourable circumstances, surgical treatment of the udder involves the danger of a serious infection of the organ.

Tumors within the body of the udder, and sometimes in the milk cistern, may be tuberculous. Such a suspicion may be dispelled only by the animal's failing to react to the tuberculin test. A tuberculous growth in the udder is beyond remedy and constitutes a real menace to the health of persons and live-stock. Seek veterinary advice.

STRICTURE OR HARD MILKING.

Hard milking is due to an obstruction or stricture, sometimes within the milk duct, but usually at the teat orifice. It may be brought about by a tenseness of the teat orifice, or by scar formation following an injury of the teat.

Treatment.—There are on the market several types of teat dilators, any one of which may be of benefit in correcting this condition. The dilator may be inserted an hour or two before milking, but the instrument should be sterile and the teat thoroughly cleansed before its insertion. After milking, the affected teat should be massaged with petrolatum into which 10 per cent. of the fluid extract of belladonna has been incorporated. The alternate use of the ointment and the dilator should be continued until the condition appears to be corrected.

When this treatment fails it may become expedient to resort to surgical measures for the relief of the stricture, but this is done to better advantage after the cow has been dried off, involving a better prospect of prompt healing, and less likelihood of causing a dangerous infection or a leaky teat. The instrument used for this operation is known as a teat bistoury, consisting of a small shaft containing a concealed blade. After the bistoury is thrust well into the teat the blade is uncovered and the instrument is rapidly withdrawn thus severing the obstructing tissues at one stroke. This procedure is usually repeated three or four times in each teat that is hard to milk, turning the blade in different angles each time. Great care must be exercised to have the instrument sterile for this operation, to avoid introducing infection into the udder. A word of caution to be taken into consideration is that this operation may result in an excessively large teat orifice, and is sometimes productive of the unfortunate condition known as leaky quarter.

ATRESIA (BLIND OR IMPERFORATE TEATS).

Atresia is a defect existing from birth, and is seldom, if ever, discovered until after the heifer has freshened. The owner's suspicion is first aroused

when one or more quarters become abnormally large, hot, and painful, while the efforts of the calf to obtain nourishment are evidently unsuccessful. Examination usually reveals the fact that the teat orifice is wanting, but there will be seen clearly a distinct ring surrounding the slight depression where the teat orifice should be.

Treatment.—Treatment is obviously surgical. The orifice may be artificially established by means of a large, sterile needle or a small bladed knife thrust through the sterilized skin perpendicularly at the centre of the depression.

To prevent closure by healing, it is advisable to insert a milk tube, with usual precautions as to sterilization, at milking time, and to replace it between milkings with a sterile teat dilator, or even a strand of antiseptic tape, to act as a seton.

Healing may be promoted by the application of an ointment of the balsam of tolu, or the fluid extract of belladonna and glycerin. Should the opening become sealed during the healing process, it will become necessary to repeat the process already described.

INSECT STINGS.

Cattle are more or less liable to the stings of bees, wasps, or hornets while grazing among clover, alfalfa, or other blossoms. The udder is a frequent point of attack because it is not so well protected by hair as other parts of the body, and, on account of its pendulous position, is more readily accessible to the aroused insect. The sting injects beneath the victim's skin an actively poisonous secretion which is highly irritating and which may eventually prove detrimental to the health and life of the skin. Insect stings, when inflicted in sufficient numbers, have been known to produce a severe, nervous depression, or even the death of the victim.

Treatment.—The injured area should be bathed in a 4 per cent. solution of ammonia or a potassium permanganate solution. Internal stimulants may be administered in the form of fluid extract of nux vomica, one-half dram, three times daily.

SNAKE BITES.

The symptoms of snake bites are local swelling and inflammation, supression of milk, fang wounds, systemic weakness, depression, blue membranes, and later coma or convulsions and possibly death. In the event of survival, abscess formation or sloughing of tissue at the point of injury may develop later.

Treatment.—Thoroughly cleanse the wound with dilute ammonia or one per cent. potassium permanganate solution. Endeavour to prevent the absorption of venom by the excision of the wound, cauterizing it, or painting it freshly with tincture of iodin. The effect of the toxin on the system should be combated with internal administrations of alcohol, coffee, digitalis, strychnin, or aromatic spirits of ammonia. An antitoxin for the counteraction of snake bites has been placed on the market.

WOUNDS OR CONTUSIONS.

Wounds of the udder may be caused by barbed-wire cuts, brier cuts, nail snags, long and jagged finger nails of milkers, bites of dogs, the trampling of teats under the hoofs of other cattle, high barn doorsills, fence jumping, goring, etc.

Treatment.—Cleanse the wound and keep it clean. If the skin is laid open or the wound is gaping, the underlying tissue should be thoroughly cleansed with an antiseptic solution, the hair should be shaved or clipped from around the injury, and the lips of the wound should be brought together and held in position by means of sutures or strips of adhesive tape. Tincture of iodin should be applied at intervals. In case of pus formation, suitable drainage should be provided, and the wound dressed frequently to prevent the germ-laden discharge from reaching the teat orifices, as such a contingency might involve the infection of one or more quarters, with disastrous consequence.

LEAKY QUARTER AND FISTULA.

When a heavy-milking cow comes up to the barn with milk dripping or streaming from one or more of her distended quarters, the wise keeper realizes that the animal should be milked three or even four times daily instead of twice. Cows of only moderate production may likewise leak milk at times if their milking is long delayed or their capacity of retention is otherwise abnormally taxed. Persistent loss of milk through teat leakage, however, is not only annoying but very unprofitable for the owner.

Chronic leaking is probably due in most cases to weakness of the teat orifice, to a fistula of the teat, or to the effects of a previous operation for the relief of stricture or other teat obstruction.

Weakness of the teat orifice may be overcome sometimes by the local application of tincture of iodin or saturated alum solution twice daily The common practice of stopping a leaky teat with a rubber band or tape, or inserting a plug between milkings, is inadvisable, as it only tends to aggravate the weakness of the part or to increase the size of the opening. Flexible collodion, into which has been incorporated 1 or 2 per cent. of metallic iodin, may be used to seal the teat orifice, twice daily, or immediately after milking.

Teat fistula, due to injuries, constitutes a common and annoying form of teat leakage. Efforts to reduce a teat fistula, however, had better be postponed, if possible, until the milking period of the animal has been terminated. The procedure, which is a surgical one, consists in scarifying the edges of the fistulous opening, bringing the lips together, and suturing them into place to establish a closure of the aperture by healing. This operation should not be attempted by one unfamiliar with the principles of surgery, however, as skill and surgical cleanliness are absolutely necessary, while at the best there always remains the danger of establishing a serious infection of the gland. The after-care consists in bathing the wound several times daily with a sterile 1 per cent. solution of table salt or a mild antiseptic solution.

If a cow in full flow of milk should receive a barbed-wire cut or other injury to the teat which would probably develop into a fistula the correct procedure would be to suture the wound immediately rather than to await the drying off of the animal and risk the consequences of a leaky quarter. The milking tube under these circumstances should always be inserted before attempting to draw milk from an injured teat.

Rudimentary extra teats should never be removed surgically unless fo a compelling reason, as it is a very common source of leaky udders.

BAD FLAVOURS AND ODOURS OF MILK.

Bad flavours and odours of milk are multitudinous in their nature and origin. Some cases are unquestionably brought about by unsuitable feed in the stall or pasture, others probably result directly from a diseased condition of the gland, while in many cases bad flavours and odours are caused by contaminated milk pails.

Occasionally a cow that is within from one to three months of calving yields milks that imparts a bitter taste when made into butter. Cattle on an impoverished pasture may yield bitter, bad-smelling milk as a result of consuming large quantities of some acrid or pungent weed. An excessively rich stall feeding, if long continued, may in time bring about undesirable flavours in the milk.

In case the milk of all cows in the herd is bad flavoured, the probability is that the feed is the cause. If on inspection only a few individual animals are found to be yielding milk that is off in flavour or odour, it is the condition of these animals that is most likely responsible. If, however, the odour and flavour are at first normal, and after the milk has been allowed to stand for a while become objectionable, the explanation will probably be found in infected milk pails or cans rather than on unsuitable feed or diseased udders.

To overcome such conditions it is first necessary to detect and remove the cause. If due to diseased udders, the animals may be isolated for treatment. If due to errors in feeding, the errors must be rectified. If due to bacterial contamination, it must be prevented by the thorough sterilization of receptacles, and other measures of sanitation in the routine operation of milking.

BLOODY MILK.

Bloody milk is a symptom of any of the following conditions: Mammitis, injury to the udder, hardening or induration, tuberculous infection of the udder, the eating of acrid or irritant feed, or an excessive allowance of protein feed. The operation of milking also may aggravate a tendency to hæmorrhage if the udder is injured or inflamed.

Treatment consists in determining the cause, if possible, and in applying the remedial measures found elsewhere in this article. The application of the following general treatment may be sufficient to afford relief in mild cases:—

Completely milk out the udder at least four times daily, at regular intervals: bathe the udder with cold water, then dry and apply camphorated oil to the quarter with gentle massage; avoid an excessively rich diet; encourage the animal to utilize as bulky a ration as is consistent with her milk production; administer an occasional dose of Epsom salt (about 1 pound) as needed, also a half ounce of saltpetre once daily. Should the hæmorrhage persist, inject several ounces of a sterile 2 per cent. tannic acid solution at blood heat into the affected quarter by means of a milking tube attached to a fountain syringe.

Redness of milk which does not appear until several hours after milking is probably due to contamination of the milk with some one of the chromogenic (colour-producing) organisms.

ROPY MILK.

Milk sometimes is ropy, stringy or slimy. The cause may be in some irritant forage to which the cattle have access, or other error of feeding, or the condition may be of bacterial origin.

Treatment.—Affected animals should be stall-fed on a properly balanced ration, or pastured on an abundant, suitable growth in a well-drained meadow. Each animal may receive a daily drench of Epsom salt, 2 ounces, and bisulphite of soda, 2 drams, in 1 quart of water.

If the unnatural condition is found to be acquired after the milk is drawn, it is probably due to lack of cleanliness at some stage of the handling of the milk. In this event, efforts should be directed toward the disinfection of utensils, and other sanitary measures.

The prompt pasteurization of new milk at a temperature of 140°F for 30 minutes should protect it from becoming viscous or assuming other undesirable properties ordinarily attributabe to bacterial action.

MILK STONE, OR CALCULUS.

Milk stone, or calculus, is a term loosely applied to concretion in the udder. Some stones are formed by coagulated casein and may be an indirect result of udder inflammation, while others are simply accumulations of lime salts from the milk, which sometimes may be distinguished by the occasional discovery of gritty particles in the bottom of the milk pail or on the strainer cloth.

Treatment.—After a prolonged, gentle massaging of the teat extremity with an ointment containing 10 per cent. of the fluid extract of belladonna leaves, the concretions, if not very large, may be passed with the aid of a sterile spring teat dilator. The injection of a small quantity of sterile olive oil into the teat may assist materially in the removal of the obstructions. In case the stones can be removed in this way it may be necessary to remove them by means of an opening in the side of the teat. This operation should not be undertaken by the inexperienced layman, as the danger of seriously infecting the udder by insanitary procedure cannot be overestimated, as well as the extreme likelihood of leaving a fistulous, leaky teat. Unless the concretions are sufficiently large to constitute an obstruction, their surgical removal, even by a veterinary surgeon, had far better be postponed until the cow has been dried off.

AGALACTIA, OR SUPPRESSION OF MILK.

The disease known as agalactia, or suppression of milk, is not infectious in cattle, as it is in sheep and goats. Neither is it so common. Occurring, as it usually does, at calving time, agalactia seems to be unfavourably influenced by such predisposing causes as indigestion, loss of appetite, mammitis, insufficient or unsuitable feed, plant poisoning, severe insect stings on the udder, thirst, enforced driving, fear or excitement, or the removal of the calf. Incidentally, agalactia is a reliable symptom seen in rabies in the cow.

Treatment.—The animal, if a heifer, should first be examined for the possibility of atresia, or imperforation, of the teats. Eliminating this possibility, the attention should be directed toward determining, if possible, the contributing cause or causes, which should receive prompt attention.

The animal should be surrounded with an environment most conducive to her comfort and complete satisfaction. She should be supplied with an abundance of fresh, clean, drinking water, and have a generous allowance of a ration, preferably in the form of a warm mash, calculated to stimulate milk secretion. Milk secretion may be assisted by the repeated administration of strychnin, one-half grain, and pilocarpin, 1 grain, in water at five-hour intervals, until six doses have been given. Massaging the udder with lard or an ointment containing extract of belladonna leaves may assist in bringing her to her milk. Efforts should be made to milk her twice daily, at regular milking time, even though the efforts are unrewarded. If the calf is brought to her side shortly before milking time, this additional appeal to her maternal instinct may have the desired effect.

MILK FEVER, PUERPERAL FEVER, OR PARTURIENT APOPLEXY*

Milk fever sometimes follows calving in fleshy or heavy-milking dairy cows. It is characterized by its sudden appearance and its acute course. The animal becomes paralyzed and passes into a semi-conscious or unconscious condition, which may terminate in death. The cause of the disease is unknown, but that it is predisposed by such causes as a highly developed milk production, an excessively nourished condition, and lack of exercise, is beyond question.

The symptoms of milk fever are characteristic and easily recognized, Soon after calving, the cow may exhibit signs of excitement and anxiety, after which constipation and colicky symptoms may be manifest. The owner may notice a staggering gait and weakness, especially of the hind quarters. Eventually the cow, no longer able to maintain the standing position, goes down and assumes the posture so characteristic of this disease with the hind legs extended forward and the head thrown back toward the flank. A comatose condition may ensue, during which there is danger in attempting to administer medicine by the mouth, as the throat muscles are temporarily paralyzed and the material may pass into the windpipe and lungs. Pulse and respiration are weak and the temperature is more frequently sub-normal than otherwise. Death or recovery will occur within two or three days, or even less.

Prevention may be favoured by the following measures. When the cow is dried off prior to calving she should be placed on a light ration of bran and a little oatmeal, supplemented with suitable hay and possibly some succulent roots or an occasional feed of silage, or beet pulp. She should be housed in a dry, comfortable, well-ventilated stable, amid sanitary surroundings, properly bedded, and given sufficient and regular exercise daily up to the time of calving. Several days prior to calving she should receive a full dose of Epsom salt.

Treatment.—This consists in the inflation of the quarters of the udder with sterile air and tying the teats with broad tapes until several hours after the animal regains its feet. The operation must be performed with the utmost regard for cleanliness. A clean cloth should be laid beneath the udder, which is then washed clean and sterilized with 5 per cent, carbolic-acid solution.

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* A fuller discussion of this disease is contained in Farmers' Bulletin 206, "Milk Fever, Its Simple and Successful Treatment," copies of which may be obtained from the Office of Publications, United States Department of Agriculture,

The apparatus, used in treatment of milk fever, for injecting sterile air into the udder, consists of a rubber-bellows arrangement attached to a rubber tubing, which in turn is connected with a hollow-metal cylinder containing sterile cotton for the filtration of the air. Another rubber tube is attached to the other extremity of the metal cylinder, and at the other end of the rubber tube is the metal teat catheter. The last tube and metal catheter should be thoroughly sterilized by boiling and the hollow-metal cylinder should be loosely packed with sterile cotton.

The catheter is then inserted into one of the teats of the previously disinfected udder, and the rubber bulb is operated by repeated compression until the quarter is well inflated. Massage of the quarter during inflation will assist in filling the recesses of the gland with the sterile air. The catheter is then withdrawn and the teat tied with broad tape. After the inflation of all four of the quarters the veterinarian will have opportunity to attend to any complication which may have arisen, or to administer hypodermic doses of strychnin, caffein, or other stimulants which may be indicated. Medicinal treatment is usually superfluous, however, in uncomplicated cases of milk fever. Following the sterile-air treatment alone, it is no uncommon experience to find the cow on her feet from 30 to 60 minutes later, eating hay as though there had never been the slightest disturbance of her normal condition.

Should the first treatment fail to give relief, the procedure should be repeated, as the air previously injected may have escaped or become absorbed. Following recovery, the tapes may be removed in about 5 hours. The air should remain in the udder for 24 hours, after which time it should be completely extracted by the manipulation used in milking. It is then safe to permit the calf to suck.

The milk-fever apparatus described above may now be obtained from many sources, as, for instance, dairy supply houses and mail-order concerns. Every herd owner should possess such an outfit as a matter of insurance.

THE QUESTION OF WET OR DRY MILKING.

In the *Journal* of the Ministry of Agriculture (London), J. Mackintosh, N. D. A., National Institute for Research in Dairying, Reading, discusses the question of wet or dry milking. Much of the criticism of dry-hand milking comes, he says, from those who have never tried that method in conjunction with systematic washing of the udder and teats. Where such a method is practised, it will be found that both milkers' hands and cows' teats become more flexible, and wet milking with milk as the lubricant becomes unnecessary and is soon recognised as a dirty habit. When a cow has sore teats, it is permissible to use vaseline during milking, but in such cases great care must be taken that the milk never touches the hands. In severe cases the milk thus obtained should not be mixed with that offered for sale.

From personal experience he has found that the adoption of dry milking, combined with careful cleaning, has resulted in the skin of the teats becoming of a soft yet tough texture, with a greater freedom from sores, and the whole operation of milking has become much more easy and pleasant. —The Agricultural Gazette, Vol. XXXV, Part 5.

AGRICULTURAL EDUCATION

ON THE TRAINING OF SCIENTIFIC OFFICERS FOR TROPICAL PLANTATION INDUSTRY.

J. B. FARMER. D.Sc., LL.D., F.R.S.,

Director of the Biological Laboratories, Imperial College of Science and Technology, London.

The Chairman (Mr. P. J. Burgess) read the following paper by Prof. J. B. Farmer, at the Rubber Conference held in Brussels in connection with the Sixth International Exhibition of Rubber and other Tropical Products, April, 1924.

The training of a scientific officer for tropical plantation industries must necessarily vary to some extent in relation to the duties which he is ultimately to be called upon to discharge. Broadly speaking, these duties or functions resolve themselves into three classes, and the requirements of each should be met by the appointment of correspondingly different classes of officers, viz :—

(A) Purely scientific officers, mainly engaged in research. Nearly related to these, and perhaps selected from their ranks.

(B) Men of scientific training and outlook, but whose main object is to disseminate information and to give advice by means of visits to different plantations and factories, and in various other ways.

(C) Agricultural scientific officers.

Men qualified to discharge the duties of any one of these three posts ought to have received a thoroughly scientific training at least up to the standard of a high honours degree at a University. An agricultural officer should, in addition to this, have had training in the principles of agriculture as practised in the field.

It will be convenient to consider separately the three main classes indicated above.

A. *Purely Scientific Officers.*—These will chiefly consist of chemists and biologists (including mycologists, plant physiologists, plant breeders, and entomologists).

(1) A chemist, in addition to having received a broad general scientific training, should have specialised at the close of his University career for at least a year in the particular aspects of chemistry and physics which bear upon the problems that will lie before him, and should have also had training in research. I do not mean by this that he ought to confine his attention to rubber, or to any other single tropical product. He will be continually faced by problems the solution of which will depend upon knowledge outside the range of his immediate subject, and for this reason it is necessary for him to possess a good all-round training. Moreover, it is not even desirable that he should have devoted his earlier research experience merely to the "getting up" of the technique of such a subject

as rubber. His time will have been better spent, from the point of view of the industry, in acquiring a knowledge of the methods and technique of physical and organic chemistry generally. Such training will be invaluable to him when he has to apply himself to the problems that will confront him in the laboratory and the factory. A man in a narrow groove is seldom or never an employee of the greatest value.

(2) Turning now to the biological staff, the training of these men should also, *mutatis mutandis*, be conducted on broad lines analogous to those insisted on for the chemists. It is essential that, in addition to their botanical acquirements, they should have had a sound training in chemistry, not to speak of other branches of science. It may be said generally that at least from two to two and a-half years are necessary to train a man properly for economic botany or entomology *after* he has received his general scientific groundwork. The particular line on which he is destined ultimately to specialise will appear during this period of his education. Thus a plant physiologist requires a much greater knowledge of chemistry and physics than a mycologist or entomologist who, on the other hand, needs to have at his fingers' ends a much more detailed knowledge of the actual plant diseases or insect pests and the technique for isolating and experimenting with them, than does the plant physiologist, and it is seldom that aptitude for both subjects is combined in one individual. A plant breeder, whose work is of a rather special kind, ought to have had practical training at one of the institutes that concern itself with this work, and he ought to have worked under the direction of a recognised leader in genetics.

From the point of view of usefulness to the industry, it is essential that every officer should be equipped with as wide a general knowledge as possible of the sciences bearing on his special subject, but it is important that during his course of training he should not be tied down in any way to the study of the particular kind of physiology or the kind of mycology or bacteriology which may appear most likely to be immediately useful to him on the plantation. In a word, a man's ultimate usefulness will depend more upon the *breadth of outlook* which he acquires during his period of training, rather than upon any *intensive knowledge of the problems which will confront him in the industry*. The latter knowledge will come soon enough when he gets to grips with the problems themselves, and the measure of success with which he is able to attack them will, other things being equal, chiefly depend upon the extent of general scientific knowledge which he is able to bring to bear upon them. Thus, I should entirely deprecate devoting a student's time to the study of rubber plantations problems. He will learn more about these problems, and learn it better (if his previous training has been what it ought to be), in two months on the plantations than he can possibly do in a year's work in Europe. As a student away from actual contact with the industry, his time will be far more usefully spent in laying a sound foundation of scientific knowledge and ideas, and of the technique and practice of research.

In addition, however, to laboratory experience, a good officer ought to have had, during his University training, some experience in the field, in order to enable him to grasp those fundamental principles which underlie so many of the reaction of plants to their environment.

For example, many problems of disease often resolve themselves into problems of nutrition, or of ration of the soil, or of water-supply, etc. When any of these conditions are defective the plant easily may—and experience shows it actually does—lose the curious quality of *resistance* to *infection*, and this is equally true whether one is dealing with the infection of a fungus or with the depredations of an insect pest. For example, it is known that inadequate aeration of the soil through deposit of silt, as a consequence of defective or deficient drainage, may so reduce the vitality of the plant by affecting the supply of oxygen to its roots as to render it an easy prey to the attack of pests and diseases which, under better conditions it would successfully resist. In making these statements I am quoting from personal observation and experience, and they can easily be verified and amplified by any one who knows how and where to look for appropriate examples.

It may be of very great advantage to a scientific officer, and still more, to his employers, if, after being selected for a post but before he is sent to take up the duties attaching to it, he is afforded an opportunity of working say for six months, at some tropical institution such as the Imperial College of Tropical Agriculture in the West Indies. There are other institutions which are also capable of affording similar advantages. The increased value of a man who has had this additional experience will be due to the circumstance that he has learnt, under skilled guidance and under specially advantageous conditions, to focus his knowledge upon tropical agriculture in the wider sense, and thus he will be enabled to short-circuit the gap between work in a European laboratory and practice in the Tropics. He will get a wider outlook on tropical problems generally, and he ought to be able thereby—and far more effectively—to concentrate on the particular ones which will face him in any individual district. I have no hesitation in saying that any expense incurred in giving an officer this additional training will be repaid to his employers many times over.

It is, of course, clearly recognised that the troubles which arise from the actual pests on the plantation are largely fungal or bacterial on the one hand, and animal—chiefly insect—on the other But it would be unreasonable to expect that a man can qualify as a specialist fitted to be entrusted with the responsibility of serving a plantation industry in dealing with pests both of animal and of vegetable origin alike. The field of knowledge is too wide for any one man to cover. But I should like to record it as my opinion that the entomologists, like the Botanists, in addition to having a sound knowledge of entomology together with the remedial measures which such knowledge indicates, should at the same time be keenly alive to the influence of agricultural conditions upon the incidence of insect epidemics. This aspect of an entomologist's scientific training too often escapes attention.

B. When a trained scientific officer reaches the district to which he is appointed, there appears to be two main types of work which may lie in front of him—namely, either that of scientific investigation, or that of the dissemination of information by means of visits to plantations, factories, and the like. Some men have greater aptitude for one kind of work than the other, and it ought to be clearly understood that it is a waste of effort, as well as of money, to be continually asking a man whose mind is set on

investigation to leave his proper work in order to take over what might be described as "missionary work." By this I do not mean that a man whose main interest lies in research should be confined to his laboratory; some practical experience, such as visits to plantations or factories can afford, he ought certainly to have. What I do mean is that to take a man of the research type and continually to be calling him off from his proper work to visit plantations for the purpose of giving advice is to misuse him, and this means a waste of money. A good investigator is not necessarily a good adviser to a planter who wants quick results, and interruption of research too often involves unnecessary postponement, or even the loss, of results of far-reaching importance to industry. Naturally, it is not possible to lay down hard-and-fast rules, but the distinction I have here drawn is a real one, and wherever possible it should be kept in mind in organising a research staff.

It is also essential that a man whose time is mainly to be spent as a scientific adviser and in disseminating information should have had a sound preliminary scientific training similar to that already laid down for the investigator, but it will be turned to a different account. His material and point of view are different. His material is the plantation itself and the men who are employed in it, and he has to study both the one and the other. At the same time, it is necessary that he should be in close touch with the sources of that new knowledge which the scientific investigators are continually acquiring. Without this, and without an adequate initial training, his work may easily be worse than useless. With it, provided he has the necessary tact and possesses practical knowledge and sense, he should form an indispensable link between the research staff and the planter. The distinction I have here attempted to draw applies, though in somewhat different degree, to other cases. Probably the entomologist, more than any one else, can combine real research with advisory functions with least loss of general efficiency.

C. The higher agricultural officers will naturally be concerned mainly or entirely with administrative and advisory work, but in their case also a scientific foundation is absolutely essential. The kind of agriculturist who only has a "practical" knowledge of the land is not the kind of person, who in the long run, is at all likely to be of most use to the industry. There are already too many examples of mistakes in agricultural practice due to the lack of the right kind of preliminary scientific training. In a word, the agricultural officer must have been trained in the *principles* of agricultural *science*, as well as in the *practice* of agricultural *art*.

One further general remark I should like to make in conclusion. All scientific officers tied down to their own districts tend to become out of date, or at any rate "stale," unless they are given the opportunity at fairly frequent intervals (say, every four years) of coming into personal contact with the progress of work as it is going on in leading laboratories and institutes, whether in Europe or in America. It ought to be clearly recognised that it is of the greatest advantage to every employer to see to it that the scientific staff are sent at sufficiently frequent intervals to renew their acquaintance with men working at home, and thus to have an opportunity for acquiring experience of the new knowledge which is continually being made. "Study leave," as it is often called, is a first-class investment from the employers' point of view, whether that employer be an individual, a syndicate or a Colonial Government.

CEYLON AGRICULTURE.

ESTATE PRODUCTS COMMITTEE.

Minutes of the Twenty-third meeting of the Estate Products Committee of the Board of Agriculture held at the School of Tropical Agriculture, Peradeniya, at 2-30 p.m. on Thursday, January 8th, 1925.

Present.—The Acting Director of Agriculture (Chairman), the Acting Government Botanist and Mycologist, the Acting Government Agricultural Chemist, Gate Mudaliyar A. E. Rajapakse, Messrs. R. P. Gorton, C. C. du Pre Moore, E. W. Keith, J. B. Coles, R. G. Coombe, J. W. Oldfield, Wace de Niese, A. T. Sydney Smith, T. A. de Mel, N. G. Campbell, H. D. Garrick, N. D. Stephen Silva, M. H. Reeves, R. F. Battams, H. B. Daniel, J. Horsfall, A. Coombe, E. Maberley Byrde, G. W. Hunter Blair, H. L. De Mel, D. S. Cameron, J. E. P. Rajapakse, W. R. Matthew, C. B. Loudon Shand and H. A. Deutrom (Acting Secretary).

As Visitors.—Messrs. F. P. Jepson, Huntley Wilkinson, Chas. Gibbon, Malcolm Park, R. V. Routledge, John Greig, J. A. M. Bond and B. A. Campbell.

The Chairman stated that letters and telegrams regretting inability to attend had been received from the Hon. the Controller of Revenue, the Hon. Mr. James Peiris, Messrs. J. W. Scott, A. F. B. Smeaton, J. S. Patterson and Dr. W. P. Rodrigo.

The Minutes of the previous meeting which had been circulated to members were confirmed.

Agenda Item 1—Progress Report, Experiment Station.

The Chairman commented on a few points in the report. He stated that a report on tapping experiments would be published shortly, and that it would include a census of diseased trees. Cacao canker had been less prevalent owing to favourable weather conditions.

Mr. H. L. De Mel asked for information regarding the manurial treatment of plantain trees affected by "Bunchy top" disease. The Chairman replied that experiments were being conducted to ascertain whether any manurial treatment had an effect on the disease. The treatment was manuring with cattle manure together with Potash. These manurial experiments had been conducted in order to test a theory that bunchy top disease of plantains was due to defficiency of potash in the soil. Potash manuring was begun two years ago by the Department but so far there was no noticeable result, and he was induced to disagree with the theory in question. Australian experience was the same. There was no evidence that bunchy top disease could be overcome by manuring.

In reply to Mr. R. G. Coombe and Mr. H. L. De Mel, the Chairman stated that he could not agree that the disease was becoming less prevalent.

Agenda Item 2—Application of Nitrate of Soda on Tea Soils.

Mr. R. G. Coombe in introducing this subject said that it was with a certain amount of diffidence that he brought up the question again, as he understood that it had been before the Committee on more than one occasion during the last year. He had been away at Home and had not been able to follow current discussion and experiments. The reason that prompted him to re-introduce the subject was because he felt that some expression of opinion was required from the Committee with regard to the application of this manure on tea soils owing to the large extent to which t was being used in several districts. His own feelings from past experience were that this manure, except on very good tea and where the soil was good, gave no appreciable results. Arising out of the general question of its utility in tea soils was the point as to whether it had any beneficial effect in areas affected by Shot-hole Borer. He had with him some correspondence to the effect that the application of sodium nitrate was efficacious in inducing the flow of sap which enabled the bush to resist the attack of the borer.

In reply to the second part of Mr. Coombe's question, Mr. Jepson stated that nitrate of soda had been included in the Shot-hole Borer experiments and that it, and sulphate of ammonia, had given the best results. The experiments were still in progress, but so far as they had gone the results certainly seemed to indicate that these two manures had a beneficial effect.

The Chairman said that sodium nitrate was not a new manure. It had been used very many years and its defects and virtues were fairly well known. He quoted Russell on sodium nitrate as a manure and in conclusion said that the probable reason for the recommendation of sodium nitrate as a manure for tea was the apparent success that followed certain experiments carried out at the Indian Tea Association Experiment Station. These experiments had been written up for the *Tropical Agriculturist* and would appear in the January number.

Mr. Alexander Bruce read extracts from Bald and various other authors concerning the value of sodium nitrate as a fertilizer, and referred to the propaganda that was being conducted in the Island in support of Chilean nitrate.

Mudaliyar A. E. Rajapakse said that he had used nitrate of soda on the Manning Coconut Trial Ground but its application was unattended by any perceptible result. He would, therefore, not advise anybody to use nitrate of soda on coconuts.

Mr. R. G. Coombe in thanking the Chairman for the information given on the subject, said that he gathered from the Chairman's remarks that it was inadvisable to apply large quantities of nitrate of soda to tea.

The Chairman said that that was the opinion of the Department of Agriculture, but they were open to change that opinion if anybody would adduce evidence to the contrary. He pointed out that it was a subject for experiment on a Tea Experiment Station, and that the condition of the bushes, as well as the yield, must be taken into account.

Agenda Item 3—Information Regarding "Thermogen" Mulch.

Mr. T. A. de Mel enquired whether any member could give him any information on this subject.

Mr. J. A. M. Bond said that he had just imported some which he had laid out on tea land between full-grown bushes. The mulch was put out in newly pruned tea, so that from the comparatively long period that must elapse before the field was again disturbed it might be possible to judge of the utility of the mulch. It was also being used over patches affected by Rosellinia and on new clearings. The planters of Hawaii claimed that it prevented wash and conserved moisture.

The Chairman said that Pabco mulch was a fibrous material made into a carpet with wax residues. It was manufactured in rolls three feet wide and in appearance resembled tarred paper. In Hawaii it was used chiefly in pine-apple cultivation where it was laid down between the rows of pine-apples. It was claimed that it resulted in a very much bigger yield of pine-apples, and that it obviated weeding and cultivation, and thus effected a large saving of money. It had also been tried in sugar-cane. The Department had been given a roll about a year ago but he thought that it had been distributed in such small pieces that they were unable to obtain any conclusive results. One piece at any rate was tried on a plot of pine-apples, but had to be taken up after a few weeks as the pine-apples were obviously suffering, probably because of the wet and compact nature of that particular soil. He did not think that there was any prospect of its use on a rubber estate. Apart from the question of cost, it would soon be broken by the coolies walking over it, owing to the presence of stones and surface roots. For the same reason it could not be used on tea. It might be applied to tobacco, but it was improbable that the tobacco grower could be persuaded to use it. With regard to its use in nurseries a minor difficulty arose, for it would be necessary to alter the Ceylon practice and to plant the seeds wider apart than was customary. It might be worth while trying an experiment with the mulch on a nursery. In Hawaii the mulch was renewed every two years.

Mr. Horsfall remarked that the mulch might be perforated so as to allow of seedlings growing through the perforation.

Mr. Chas. Gibbon enquired whether such covering of the soil was not opposed to the general principles of agriculture and whether it would not favour the development of fungi in the soil. The Chairman replied that fungi did not appear to grow on the mulch itself, and that it probably contained some preservative substance, but the exclusion of cultivation and aeration of the soil was contrary to accepted methods of agriculture.

Mr. Wace de Niese said that his experience ot Pabco mulch was that it did not last three months.

Mr. Garrick suggested that the mulch might be tried in special cases such as supplying old tea etc.

The Chairman said that it was claimed that the increased yields obtained were due to retention of moisture and heat, and the prevention of weed. It was, however, possible that the mulch might furnish some substance which in very small quantities acted as a stimulant. Its method of action required investigation.

Agenda Item 4—The Latest Information on Grafting and Budding Rubber.

Mr. N. G. Campbell asked for the latest information on this subject, stating that on his return to Ceylon he had noticed that interest in it appeared to have died out.

The Chairman said that budding appeared to be ignored and few estates were taking any interest in it. A summary of the work done in Sumatra and Java had been published in the October number of the *Tropical Agriculturist*, and it was evident from that that important advances had been made, more especially as regards the use of budded trees for obtaining pedigree seed.

Mr. Campbell asked whether that meant that budding had been abandoned, in answer to which the Chairman stated that that was not the case at present, but it was expected that ultimately pedigree seed would be obtained by crosses between budded trees and only such seedlings used for planting. He also stated that steps were being taken to secure a block of land for this work by the Rubber Research Scheme. He considered it urgently necessary that estates should immediately take steps to ascertain their best yielding trees and keep them under observation, both as regards yield and disease so that mother trees for budding material should be available when required.

Agenda Item 5—Taragama dorsalis.

Mr. E. W. Keith enquired whether information was available with regard to this pest which was attacking dadaps and cacao.

Mr. Jepson in the absence of Dr. Hutson read a memorandum written by the Entomologist. He said that *Taragama dorsalis* had been known as an occasionally serious pest of Dadap in Ceylon for many years. Dadap appeared to be the favourite food plants of the larvae in all stages, but the older caterpillars after stripping the dadaps will usually do more or less damage to the tea, rubber or cacao amongst which the dadaps are being grown. Records of previous outbreaks indicate that the pest may first become noticeable towards the end of September or early October, that it becomes serious in November and December and then gradually almost disappears, but may reappear again the following year in September. If the outbreak is noticed on the dadaps in the early stages it is safer to have the attacked dadaps lopped or partially lopped at once. Otherwise the pest increases rapidly and devastates large areas and lopping usually becomes necessary later on. The collection and destruction of caterpillars and cocoons is the only practicable method after the pest has become well established. A look-out should be kept for future outbreaks and these should be checked in the early stages.

H. A. DEUTROM,

Acting Secretary,

Estate Products Committee.

FOOD PRODUCTS COMMITTEE.

Minutes of a meeting of the Food Products Committee of the Board of Agriculture held in the Legislative Council Chamber at 12 noon on Thursday, January 15th, 1925.

Present.—Mr. T. Petch, Acting Director of Agriculture (Chairman), the Hon. Mr. James Peiris, the Hon. Mr. T. B. L. Moonemale, Gate Mudaliyars L. A. Dassanayake and Harry Jayawardene, Mudaliyars W. A. Amarasekera, G. Goonetilaka, Edmund Peiris, E. F. Edirisinha and S. Muttutamby, Messrs. C. Drieberg, H. L. De Mel, C. B. E., C. E. A. Dias, N. D. S. Silva, J. P., Dr. W. A. de Silva, T. Waloopillai and S. Tyagarajah, the Divisional Agricultural Officers Northern and Southern Divisions, the Economic Botanist and Muhandiram N. Wickramaratne (Secretary).

The Minutes of the meeting held on August 27, 1924, were confirmed.

Agenda Item 2—Preparation of Lists of Crown Lands available in Villages.

Mudaliyar E. F. Edirisinha moved the following resolution, viz:—

"That it is desirable in the interests of Agriculturists that all available Crown Land (for sale outright or for lease) should be carefully defined for each Village, Korale or Division and that lists of such available lands should be distributed among villagers and those likely to be interested in the development of such lands."

and said that the villagers did not know what lands were available for sale and lease in the villages and there was considerable delay in obtaining lands for cultivation under the existing system. He suggested that lists of lands available for cultivation should be prepared giving boundaries, the probable extent and the locality through the Government Revenue Officers for the information of the villager and others. It should assist in obtaining lands without delay and the lands could be brought under cultivation almost immediately.

Mr. C. E. A. Dias in seconding said that even the Capitalist classes could not get applications for lands through for years and that a full enquiry into the question was essential.

The Chairman, Mudaliyar G. Goonetilaka, Mr. James Peiris, Mr F. Burnett, Dr. W. A. de Silva and Mudaliyar Harry Jayawardene took part in the discussion which followed.

Mudaliyar Goonetilaka remarked that application for lands might be referred to the Forest Department who would report upon their availability.

Mr. James Peiris said that he was quite in sympathy with the object of the motion, but he thought that there was a difficulty to overcome, namely as to which of the Departments should be entrusted with the work.

Mudaliyar Jayawardene also wanted to know who would be asked to prepare the lists.

Mudaliyar Edirisinha replied that the Government Agents might be asked to prepare the lists and that lands be given on tickets of occupancy.

Dr. de Silva remarked that he knew of instances where villagers who had cultivated lands on tickets of occupancy were prosecuted.

Mudaliyar Edirisinha moved the deletion of the words "carefully defined" from the motion.

The Chairman said that the resolution as amended might be forwarded to the Board of Agriculture for consideration. This was agreed to.

Agenda Item 3.—Standardization of the "Kurunie."

Mudaliyar W. A. Amarasekera moved for discussion the following resolution passed at a meeting of the Matara District Agricultural Committee:—

"The Kurunie being widely used as a measure of capacity of grain should be standardized by law as the equivalent of ⅛ bushel in view of the local variations in the capacity of the measure."

He said that the Sinhalese measure "Kurunie" was universally used in measuring paddy and other cereal grains. It differed in capacity, some being large and some small. A large "Kurunie" was used in buying and a small one in selling grains by unscrupulous men and the poor villagers were placed at a great disadvantage. It was therefore necessary to standardize or legalise the capacity of the "Kurunie."

Mr. T. Waloopillai seconded the motion. Mudaliyar Harry Jayawardene, Mr. James Peiris, the Chairman and Muhandiram Wickremaratne offered remarks.

Mudaliyar Jayawardene said that in some cases "full" kurunies and in other cases "cut" kurunies were used. Their probable capacity being 1/6 and 1/8 of a bushel respectively.

Mr. James Peiris agreed that the proposal was a good one.

The Chairman explained that similar differences existed in England and that the legal bushel did not agree with other bushels in use in the country and that standardization was a comparatively recent idea.

Dr. de Silva pointed out the difficulties in the way of standardizing the Kurunie to suit the bushel while the other measures were left as they are.

Mr. Wickremaratne said that the Kurunie or Laha was part of a Sinhalese measure and that it was not practicable or desirable to standardize a Sinhalese measure to the English standard of a bushel. What was desired was not to combine the bushel and the kurunie but to have a uniform kurunie measure for all districts. The kurunie should always be one-tenth part of a pela.

The Chairman suggested that the motion be amended by the deletion of the words "as the equivalent of ⅛ bushel." This was agreed to and the resolution amended as follows was adopted:

"The 'Kurunie' being widely used as a measure of capacity of grain should be standardized by law in view of the local variations in the capacity of the measure."

Agenda Item 4.—Restoration of Akkatimurippu Scheme.

Mudaliyar S. Muttutamby moved:

"That owing to the uncertainity of the local rainfall it is necessary to restore the Akkatimurippu Scheme."

Mudaliyar Muttutamby explained the difficulties in the way of proper cultivation in the district of Mannar owing to the uncertainty of local rainfall

and the meagre water-supply available in village tanks. He said that the local people could not make any progress in the matter of paddy cultivation unless and until a larger scheme such as the one under discussion is restored so as to feed the village tanks in the district for the benefit of a population who were already there. He preferred this to the construction of big works for future development of land in the neighbourhood and a population to come.

Mr. S. Tyagarajah seconded.

The Chairman thought that the consideration of this scheme would entail the reversal of the present Government policy with regard to the suspension of construction of major works. A general discussion followed in which Mr. James Peiris, Dr. W. A. de Silva, Mr. H. L. De Mel, Mr. T. Waloopillai and Mr. C. Drieberg took part.

Mr. Waloopillai was of opinion that it was not necessary to wait for other schemes and that the present scheme was brought forward by one who knew the district, and it was up to the Committee to support it after considering whether it was deserving of support.

Mr. Drieberg suggested that the matter be referred to the Government Agent of the Province for his report.

The Chairman put this suggestion to the Committee and it was agreed to.

Agenda Item 5.--Internal Communication.

Mudaliyar Muttutamby next moved the following motion:

"That as the Mannar District is flat and becomes swampy in wet weather, Government be urged to pursue a liberal policy in improving the means of internal communication."

In support of the motion he said that the lack of communication in the Mannar District was a hindrance to the progress of agriculture, and there were not sufficient roads in the district and even these roads which were there were entirely bad. He urged that improvement of roads in the district should be undertaken.

Mudaliyar Goonetilaka referred to the vote allocated for the improvement of village roads.

The Chairman remarked that that was a matter for the Assistant Government Agent. He or the representative in the Council or other influential people should take the matter up.

Agenda Item 6.—Encouragement of Growing of Plantains.

Mr. H L. De Mel, C. B. E. moved:

"That the growing of plantains be encouraged by Government in every possible way."

He spoke of the dietetic qualities of the plantain fruit, and stated that the price of plantains had gone up 400 per cent. and the demand for plantains was large. He said that Government should encourage the growing of plantains.

Mr. N. D. S. Silva, J. P. seconded the motion and said that plantain disease was spreading and that steps should be taken to check the spread of the disease.

The Chairman explained the present position with regard to the existence of plantain disease. He said that the cause of the disease has not been traced as yet. The disease was known in various countries. In Australia research work was being extensively carried out and results are being awaited.

Mr. De Mel asked whether the Rambukkana District was immune from the disease, and the Chairman said it was not.

Mr. De Mel suggested that the lands allotted for food production such as were found in Hapitigam Korale might be utilized for growing of plantains.

Mudaliyar Dassanayake said that the lands in his Korale which were allotted for food production had been planted with jak plantations.

The Chairman put the resolution to the meeting and it was carried.

N. WICKRAMARATNE,
Secretary,
Food Products Committee.

PROGRESS REPORT OF THE EXPERIMENT STATION, PERADENIYA.

For the Months of November and December, 1924.

TEA.

The yield for the month of November was 3,590 lb. green leaf from 11 acres; that for December 4,280 lb.

The total output of green leaf for 1924 is 37,593½ lb. from 11 acres; and an average of 413,716 lb. green leaf equal to 825 lb. of made tea.

Plot 150 (Albizzia) has given the highest yield, 4,692 lb. green leaf equal to 1,133 lb. made tea per acre.

The young bushes in the Hillside tea have been topped at 15 inches; 34 diseased tea bushes from 11 acres were uprooted and burnt. The highest losses on this occasion occurred in the Assam Indigenous plots.

The tea drains were cleaned. Weeding which was in arrears was got up to date at the end of November. The nurseries look well and healthy and have had liquid manure applied to them.

RUBBER.

The rubber trees in plots 63-67 above the young cacao planted in 1914 have been marked with a single cut at 20° on the half circumference at 24 inches from the ground, preparatory to bringing them into tapping for the first time from January, 1925.

The trees in plot 140 D behind the store lines planted in 1914 with two year old stumps from Dr. Lock's selected good latex yielder tree No. 39 at Heneratgoda have also been marked to be brought into tapping for the first time from 1st January, 1925. Individual yields will be kept from these trees.

A census of diseased trees is being taken to be included in the report on the tapping experiments for 1924.

CACAO.

Two rounds of picking have taken place yielding a fair crop, the percentage of fungus pods being much less than in the previous two months.

Fifty-eight cwt. of Cacao have been sent for sale in Colombo, the highest offer being Rs. 55 per cwt. for unselected beans.

Branches of Red, Green and Crimson Nicaragua were layered for planting out in the Economic area.

COFFEE.

Crop prospects appear very good. There is a large demand for Robusta and Quillou coffee seed and plants.

The upper and middle portion of the 6 acre coffee field has been planted with Quillou, Uganda and Hybrid coffee plants from the Experiment Station nurseries. The plants were removed with the aid of the transplanting tool.

The Leucaena and Gliricidia shade in plots 140 E, F, G, M and N have been lopped and mulched round the coffee trees. Every alternate shade tree in these plots has been uprooted as they were found to be too close. All the coffee trees, including those in the Economic area and under rubber, have been systematically pruned.

COCONUTS.

A census of coconut trees was taken in December. There are in all 1,800 trees in bearing and 614 young trees not in bearing. The yield of nuts for 1924 is 48,497 being an average of 26 9 nuts per tree in bearing. The greater part of this crop was harvested from old palms scattered throughout the cacao and the old grass fields of the station.

The palms in the 10 acre block were weeded round and coconut husk and fallen branches, etc., mulched round some of the palms.

All couch and iluk have been eradicated from this area.

FIBRES.

The following yields have been obtained from the plot of Rozelle fibre (Hibiscus sabdariffa var. Altissima) planted in the Annual Economic area in June and harvested in October, 1924 :—

Name of variety :—Hibiscus sabdariffa var. Altissima.
Date of sowing :—12th June, 1924.
Method of sowing :—In drills 1½ ft. apart.
Quantity of seed sown per acre :—12 lb.
Nature of soil :—Old cacao land of poor quality.
Date of harvesting :—30th October, 1924.
Weight of stalks per acre (lb.):—15,640.
Average length of fibre :—8—9 ft.
Weight of clean fibre per acre :—948 lbs.

FODDER GRASSES.

Of the five new fodder grasses received from the Department of Agriculture, Southern Rhodesia, and planted in the Fruit plots only two have germinated and are growing well, viz., Buffalo grass and Native Paspalum.

Buffalo grass is well spoken of in Rhodesia. It is stated that in either its green or dry state all stocks are extremely fond of it and that its feeding value is high. It is said to be a valuable pasture grass and well deserving of being laid down in large areas.

Native Paspalum is also said to be an excellent fodder when young and succulent, stock feeding on it readily. A full season's growth when cut has yielded 19,950 lb. of green fodder per acre in Rhodesia. It is said to grow best in swampy land.

ANNUAL ECONOMIC AREA.

Adlay (Coix lachrymæ, var. Bakindoun). A crop of this food grain harvested in December yielded well—82 bushels or 2,736 lb. of grain per acre, but with closer planting this might be greatly increased. Adlay may prove a valuable food asset as not only can it be eaten boiled, but it makes a most excellent flour of first-class strength.

Victor cowpea has been harvested, yielding 148 lb. of dry seed per acre.

GREEN MANURES AND COVER PLANTS.

The new varieties received from Jamaica are all doing well with the exception of Ghlorophera tinctoria, seed of which did not germinate. Rooted cuttings of Desmodium triflorum and Desmodium heterpphyllum were planted in contour belts under old rubber in plot 87.

Indigofera endecaphylla and Centrosema pubescens planted under Avenue rubber have completely covered the ground A large number of cuttings for trial have been supplied to applicants. Seed will be available for distribution about February or March next.

The ¼ acre plot of Tephrosia candida was cut for the second time, yielding 2,877 lb. of green material or 11,508 lb. per acre.

GENERAL.

Hubam Clover.—The plot of Hubam clover has been resown.

Bunchy-top Experiments.—Holes have been dug between the existing rows of plantains for replanting with healthy suckers, and the manurial treatment will be repeated.

Dioscorea Yams.—The following varieties have been lifted. The calculated yields per acre are as follows :—

Variety.		*Yield.*
Angili-ala	...	19,598·4 lb.
Angelala	...	16,604·2 ,,
Kiri-kondol	...	7,077·2 ,,
Baeton	...	17,965·2 ,,
Klapa	...	20,405·0 ,,
Mauritius white yam	...	9,254·8 ,,
Kahata kondol	...	17,693·0 ,,
Kiri-kondol	...	9,527·0 ,,
Mauritius red yam	...	10,615·8 ,,
Vel-ala	...	7,621·6 ,,
Cush-cush	...	12,793·4 ,,
Kiri-vel-ala	...	4,083·0 ,,
Kahata ala	..	9,527·0 ,,
Hingurala	...	9,527·0 ,,

A small experiment has been initiated to eradicate Iluk by weeding the plot and pulling out the tender roots as they come up Digging out the roots has proved expensive.

Branches of the following fruit trees were layered by the gootee method for supplying an order :—Sapodilla, Orange, Mandarin, Limes, Uguressa, China guava, Pomegranate and Lovi-lovi.

The low jungle along the river bank at the Getambe area is being cleared and burnt.

RAINFALL.

		Inches.	*Wet Days.*
November	...	6·48	17
December	...	5·24	11

H. A. DEUTROM.

Acting Manager,

Experiment Station, Peradeniya.

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CO-OPERATION.

THE CO-OPERATIVE MOVEMENT.

SIR LESLIE WILSON.*

It is a great pleasure to me to come here this morning to inaugurate the 13th meeting of the Bombay Central Co-operative Conference. The movement is one with which I have very great sympathy, but before making any remarks about the movement as such, I should like to say a few words on the subject of co-operation, in its wider sense.

It is undoubtedly a fact that Co-operation is the basis of practically all useful endeavour—and this Co-operative movement has done more than anything else to give to the inhabitants of the towns and villages in the Presidency a real sense of responsibility, and has enabled them to realize how much they can do by self-reliance and mutual trust.

Co-operation is constructive and is progressive in every way. This movement has shown, more clearly perhaps than any other, the great results

* Speech at the opening of the Bombay Provincial Co-operative Conference.

which can be obtained by putting into the hands of those primarily interested in agriculture, the opportunity of assisting themselves and their fellow-men by accepting the responsibility of advancing money for essential agricultural purposes; and in few cases indeed have those in charge of Co-operative Village Societies found that the confidence they have placed in their fellow-villagers has been displaced.

I have on several occasions discussed the whole question with the Registrar, and I should like here to pay my tribute to the great services Mr. Madan is rendering to the movement. He has given me instances in which quite small villages have built up on thier own initiative comparatively large reserves of money, available for assistance to the ryots of their village, by efforts entirely due to the personal enthusiasm and enterprise of one or two men in the village in whom their fellow-villagers have complete trust and confidence. There is a great deal in this—far more than would appear from the few words I have spoken. What seems to me to be wanted in this Presidency more than anything else is a feeling of self-reliance, self-confidence and a trust in others among the many instead of among the few. The Co-operative movement affords an opportunity to very many to bring into being those most essential attributes; and when, as is, I am glad to say, the case, the efforts of a few in the villages throughout the Presidency are so successful in proving that there does exist an initiative and sense of responsibility, this movement, even if it were unsuccessful, which it certainly is not, would have achieved much.

CREDITABLE ACHIEVEMENTS.

The Co-operative movement, which has now been in existence for some 20 years, has already to its credit very remarkable achievements. The results so far obtained are most encouraging, and I believe that the movement is now so popular that in many cases cultivators come forward themselves to join Co-operative Societies instead of waiting to be persuaded as was the case only a few years ago.

The Central Co-operative Institute, of which I am proud to be the President, has now reached the fourth year of its existence. It was clear that a movement which was expanding so rapidly required some central body to co-ordinate its activities, and I think you will agree with me that the Institute has already done much to justify its existence.

One of the most important questions which you will have to consider is that of the Co-operative Societies Bill which has been introduced into the Legislative Council. A very large number of amendments to the Bill have been proposed, and these will all have to come before the Select Committee. The delay which has taken place will probably be found to have been, in the end, of great advantage, for the Conference will now have an opportunity of discussing the provisions of the Bill, and the members of the Select Committee, whom, I am glad to find, you have invited to attend the Conference, will have an opportunity of ascertaining the views of representatives from all parts of the Presidency. I have every hope that, when the Bill again comes before the Council, it will be such as to satisfy all those who have the interests of the Co-operative movement at heart.

I do not wish to go into the detailed activities of the Co-operative movement in this Presidency. There is, however, one point which I should like to mention. When I was recently at Dharwar it was brought to my notice that the procedure for placing at the disposal of agriculturists money advances out of the Tagavi grant was unnecessarily cumbrous, and that the rate of interest which members had to pay was rather heavy. I am glad to say that the whole question has been carefully discussed by the Registrar and the Provincial Bank, and steps have now been taken not only to expedite the disposal of such applications, but also to reduce the rate of interest, so that members of Co-operative Societies will be charged no more than a non-member borrowing directly from Government.

A CAUTIOUS POLICY.

Reviewing, however, as shortly as I can, the progress made by the movement during recent years, I find that in the last 3 or 4 years a cautious policy has been followed, and I think rightly followed, aimed at the consolidation, and improvement of the existing Societies rather than at their multiplication. During the last year, for instance, the total number of Societies showed an increase of only 210. The number could easily have been considerably increased, but it was thought that our energies could more usefully be concentrated on arranging for better supervision of existing Societies, and removing the defects which had grown up rather than at organizing new Societies. Although the increase in the number of Societies was small, the number of members went up by 21,000 and what is really more satisfactory is that the working capital increased from 533 lakhs to 619 lakhs, showing an increase of 16 per cent. in one year. When we consider that only 5 years ago the working capital was barely two crores, the fact that it has trebled itself in spite of adverse circumstances during that short period would go to show that the movement has gained very much in public confidence. Another noteworthy feature about this working capital is that nearly 50 per cent. of it is the members' own. The working capital in the movement is, as I stated above, now about 6 crores and 19 lakhs. Out of this, it is true, a part, about a crore or crore and a half, advanced by Central Banks to Societies and distributed by them amongst their members, is counted twice over. I find, however, that, out of the 6¼ crores, 2¼crores represent members' deposits, 75 lakhs their share capital, and 32 lakhs the reserve fund. This increase in the Societies' own capital is undoubtedly a source of considerable strength and stablity to the movement, which aims at being eventually entirely self-reliant.

A SOURCE OF ANXIETY.

One discouraging feature of the working of agricultural societies in recent years has been the growth in overdues. It requires little thought to see that a movement which depends on credit and on the confidence which it inspires in the public, would suffer very seriously if members cannot repay their dues promptly and punctually. The continual growth in the percentage of arrears during recent years has, therefore, become a source of anxiety, although it must be noted that this percentage in our Presidency has always been very much smaller than the percentage prevalent in most of the other major provinces in this country. In 1922, the arrears amounted to 12 per cent. of the working capital. This increased to 18 per cent. in 1923. Special efforts were, however, made to check this upward tendency, and although

the last season was not favourable in several districts, the amount of overdues was reduced, and, with the favourable rains that we have had this year, it is hoped to reduce them still further. It is of course necessary, when the seasons are bad or unfavourable, to grant extensions, but the tendency in some of the societies to grant extensions wholesale, or to take no steps against recalcitrant members, must be checked if the movement is to grow on healthy lines.

With better supervision it is likely, almost certain, that not only will the overdues be considerably reduced, but the general tone and management of societies will improve. We have, in this Presidency, so far followed a policy of leaving the societies to themselves. So long as the societies follow their rules and bye-laws, there is little, if any, interference in their internal management from outside. Societies' accounts are audited every year by the Government Auditor. They may be visited occasionally by the Registrar or the Assistant Registrar or the Honorary Organizer. There are, however, several societies which do not receive any visit from any outsider, except the Auditor, during the course of the year. It is in these societies that very often slackness and deterioration set in. The question about arranging for supervision was, therefore, very carefully considered by a Committee appointed by this Conference, and acting on its recommendation, steps are being taken for the organization of Supervising Unions, which will appoint well-paid and well trained Supervisors under the guidance of the Union Committee to inspect societies periodically. I attach very great importance to these measures, for I believe, and I am sure you will agree with me, that unless proper and regular supervision has been provided for, it will not be safe to go on increasing the number of societies, nor can we expect great progress in many of the existing ones. In our Presidency we have limited our official staff almost to the bare minimum required to carry out the duties required under the Act, and the best way, therefore, to provide for the supervision is to organize the societies themselves into Unions for the purpose, so that supervision will be internal, *i. e.*, by the societies themselves, and not from outside. I hope that the Institute and its Branches will pay special attention to the organization of such Supervising Unions during the current year.—Mysore Economic Journal, Vol. X, No. 12.

WITHOUT THESE, NO CO-OPERATION.

The man who knows what co-operation means thinks, talks, and acts co-operation every day of his life. He is always building up a greater confidence in co-operation among his friends and neighbours through support of every co-operative effort. He counsels patience when others only criticise. He offers suggestions in a spirit of sympathy when others merely denounce. He shows a desire to understand the difficulties of co-operation instead of being over critical about details. There can be no co-operation without these three—Patience, Sympathy, and Understanding.—Agricultural Gazette of N. S. W., Vol. XXXV, Part 10.

GENERAL.

HAWAIIAN SUGAR PLANTERS' EXPERIMENT STATION.

All Hawaii benefits by the activities of the experiment station of the Hawaiian Sugar Planters' Association.

Directly, in the increased yields of sugar and increased amount of money distributed among the thousands of employees and stock-holders of the plantations ; indirectly through the increased purchasing power and distribution of money in all branches of trade and business.

Directly, too, Hawaii benefits by forestation, by control of insect pests, by assistance given to other industries and other enterprises by the sugar technologists and experts in various lines of science.

And so the experiment station of the sugar industry is a semi-public institution. It is conducted as such, with its doors always open to the serious seeker for information, and with a readiness to help Hawaii in a wide variety of ways.

The experiment station is essential to the sugar industry ; its work is vital to the preservation of cane from Nature's enemies, and to the development of field and mill methods.

Due to the intensive nature under which sugar is grown in Hawaii the industry is naturally harassed by difficulties which are ordinarily not deemed of great consequence in countries where growing is of the more extensive nature. Fertility problems, insect enemies, labour saving devices, irrigation problems and a host of other considerations do not lend themselves as readily to solution and are of greater consequence here than under conditions where economy of production is not the paramount issue.

Naturally the activities of the experiment station are constantly engaged in those channels which will place the sugar industry of the Hawaiian Islands on a sounder basis with regard to economy of production, and those influences which are accountable for it.

A PART OF PLANTATIONS.

The experiment station should not be regarded as a unit apart from the plantations themselves. It is rather a part of the plantations with which it co-operates and by which it is supported in accomplishing work which, through their collective aid and support, are made possible. In fact, much of the experimental work, particularly in the later phases, is carried on at the plantations. In addition to the central experiment station, at which laboratories, trial plots, the general offices and a library are maintained, there are several branch stations located at advantageous points throughout the islands.

Thus it may be seen that this collective effort becomes a striking example of the co-operation of business enterprise with science and its resultant application to an industry.

The sugar industry of Hawaii is so closely allied with scientific development induced by the needs of the industry that there is little doubt it would long ago have been forced to retire from the field of agricultural effort here were it not for the foresight of early planters who recognized the necessity of coupling science so effectively with their plantation activities.

Recognition of this did not come, however, until in 1895, when the Hawaiian Planters' Labour and Supply Company was reorganized and became known as the Hawaiian Sugar Planters' Association, just as it is to-day. In 1895, to cope with the problems arising from the single crop system and resulting soil fertility depletion, Dr. Walter Maxwell, agricultural chemist, was secured to aid in the solution of this difficulty. The necessity for the use of commercial fertilisers was recognised to some degree as far back as 1878, and out of this problem arose the necessity of securing enlightened scientific knowledge as a guide to its use.

Before coming to Hawaii, Dr. Maxwell had already earned an enviable reputation as an agricultural chemist, and had, through his connection with the United States Department of Agriculture, worked extensively with sugar-growing problems.

FINE RECORD MADE.

Having laid the foundation of the scientific aspect of their industry, the Hawaiian Sugar Planters' Association aggressively pursued it to the end that at the present time it has extensive facilities for the promotion of this all-important branch of the sugar industry of Hawaii. To-day the experiment station can point to the past with pride in the knowledge that served well not only as a protective agency against insects and disease which have harassed the cane since its beginning, but to the results of the enlightenment cast by it upon the industry as a whole, from the development of new varieties of cane, and the solution of fertility and fertilizer problems, to its contribution all along the line from planting to milling.

Its growth may be shown in a general way by the cost of maintenance. In 1895, the cost of experimental work was only $7,000. From then it made gradual increases each year, being double that amount five years later. In 1905 the expenditures reached a high point at approximately $114,400 and dropped to $2,500 in 1910. In 1920 the cost of maintaining the experiment station was $197,000. For the years 1895 to 1920, inclusive, the cost totalled $1,983,500.

One naturally questions whether this vast expenditure of nearly two millions of dollars justified itself. Answering that question, Director Agee, in his report of October 20, 1920, said:

"It is not feasible, of course, to be specific and prepare a summarised statement covering the value of the station to the sugar industry. Suffice it, therefore, to point out certain items of benefit which show, as we believe, that the annual gain now resulting and likely to continue year by year, offsets by far the total outlay for the entire twenty-five-year period:

PEST DAMAGE CHECKED.

"(1) The striking achievements in economic entomology deserve first consideration. The damage that was being done by the leafhopper at the time it was placed under parasitic control has been very conservatively estimated at three million dollars per year."

"(2) The cane-borer damage up to the time of its subjection was hardly less than one million dollars annually. The Anomala-beetle damage was rising at a rate that promised to place it alongside of the borer in the seriousness of its menace, when it was wiped out as a pest through an introduced parasite."

Thus he outlines only a few of the contributions of the experiment station to the industry. He mentions also the aid given through protection from introduction of disease, knowledge disseminated in problems of fertility, and in factory lines.

One of the great contributions was made through the development of the H-109 variety of cane. Mr. Agee estimates that the gain yearly in income from this one source (the growing of H-109) approximates $3,500,000.

He adds that projects of the experiment station are such that much of the work of to-day is not reflected in commercial advantages until 5 or 10 years from now, and even then the returns lack much in the way of precision.

Mr. Agee asserts that to-day, after 30 years of exhaustive scientific work in connection with Hawaii's sugar industry, several of the major problems have been solved. To be true, there is important work to be done, work which is always widening in aspect. For example, at the present time of importance is the development of a cane variety which will be well suited to the adverse conditions prevalent on the islands of Kauai and Hawaii, in relation to climate and soil. What is being sought is a variety which will ratoon well, retard the growth of weeds and which will not require replanting at frequent intervals. Effort is now being made in this direction.

SUBSTATION MAINTAINED.

The station maintains three substations on the island of Oahu, and on each of the islands in addition, it maintains an agriculturist, who co-operates with the various plantations in field experiments. Thus at the station itself, one gains only a limited view of the activities of the various departments. However, since it is at the experiment station that much of the experimental work is done, either in co-operation with the plantations or distinct from work which they are doing, a brief survey of the present activities of the various divisions of the station yields a wealth of information regarding the scope of the work which is being done by the plantations and by the station in co-operation with them.

Prevention of the introduction of new diseases is the important work which is being carried on in the pathology department under the direction of H. Atherton Lee. The assumption is, and it is quite true, that it is cheaper to exclude diseases than to fight them after their introduction.

"In Formosa, the Philippines, India, Java and Australia are a number of sugar-cane diseases which would cause us no end of grief if they were introduced here," Mr. Lee declares,—"While there is little doubt that we could cope with them, what we propose to do is to exclude them as far as possible.

"For example, at the present time in Australia and in the Philippines are two diseases to which our famous H—109 variety is particularly susceptible. If these diseases were allowed to gain a foothold here they would cause losses of millions of dollars a year."

Attention of this department is also being given to a new disease at Kohala on Hawaii. Since effort has already been rewarded with the discovery and isolation of the casual organism, it is hoped soon to eliminate losses from this source by the development or introduction of restricted varieties of cane. These are now being tested.

WATER IS VITAL.

H. L. Lyon, who is in charge of the forestry division, believes that the conservation of water is the pre-eminent question of the day and future. The natural forests of the islands are rapidly being wiped out, and, although reforestation is being made a major project of the station, he believes that the seriousness of the water-supply factor cannot be over-emphasized.

The importance of getting forests on the watersheds, thus to serve as a retainer to prevent the rapid run-off is of first importance. To accomplish this, expensive experiment work has been done and is being pursued in bringing to the islands from elsewhere trees which will thrive under conditions here. At the present time the watersheds are rapidly becoming depleted of vegetation, and as a consequence the loss of water through run-off to the sea where it is irretrievably lost is tremendous.

The introduction of foreign vegetation is necessary because natural shrubbery and trees are decidedly of a sensitive nature. As a consequence, contact with man and domestic animals is constantly causing the depletion of native vegetation.

Work now being conducted under the direction of J. A. Verret, chief agriculturist, at the experiment station is chiefly concerned with the breeding of more hardy cane varieties. The effort is directed toward the development of varieties with strong root systems, good ratooning ability which will have a resultant effect of reducing labour requirements. Breeding work to introduce canes which have greater resistance to disease is closely associated with this effort.

Bud selection is another phase of the work which Verret and his staff of agriculturists are employing in their effort to develop improved qualities in standard varieties and thus prevent them from losing qualities which they now possess as they have a tendency of doing naturally.

The agriculturists are not confined to the station in this very important work. On each of the islands one of the agriculturists has supervision of the particular work being carried on there. They concern themselves with problems of fertilisation, liming, methods of cultivation, effect of elevation and other considerations.

SOIL CONDITIONS STUDIED.

One of the phases of the work which is being followed in the chemistry department is that which concerns itself with the relation of soil conditions to diseases of the cane. This department is under the direction of Guy R. Stewart, assisted by W. T. McGeorge, Fred Hanson, C. L. Crutchfield and F. R. Van Brocklin.

Soil conditions, it is held, predispose plants to invasion by disease organisms. The lack of some essential factor in the soil thus allows the entrance of the secondary factor, namely, disease organisms. With this knowledge as a working basis, the department is systematically endeavouring

to determine definitely those factors lacking or prevalent in the soil which are causing this predisposition of the plant to yield to diseases, or are allowing the entrance and persistence of these disease organisms in the soil.

In addition to its disease control activities as stated above, the department conducts soil surveys and investigates problems concerning soils, and makes analyses of all fertilisers which are to be used on the plantations.

What are considered the most spectacular accomplishments made in connection with experimental work conducted by the station came through the efforts of the entomological division. This section is under the direction of O. H. Swezey and F. Muir. Swezey is now the oldest member of the station staff, in point of service, having joined the department in 1904. Muir entered the work the following year.

The introduction and establishment of parasitic insects to prey upon harmful insects is, briefly, a definition of the activities of the division of entomology. Through this work vast savings amounting to millions of dollars have been made possible in the sugar industry of the Hawaiian islands. Although its accomplishments have been many and spectacular, the department is not relinquishing its watchfulness in the slightest degree, and it is ever on the watch to cope with new problems which may arise.

The effective control of leafhopper, cane borer and the Anomala beetle are numbered among the outstandingly noteworthy accomplishments of the entomologists. Now, after years of constant vigil, they report that these three sources of at one time vast losses are now practically eliminated.

GO FAR AFIELD.

Among the late developments in this department is the return of F. X. Williams, assistant entomologist, from South America after two years' search for parasites of the wire worm. H. T. Osborne, also an assistant, has been in Mexico for the past three years endeavouring to secure parasites to prey upon the cane borer and army worm.

In all its effort to solve the difficulties facing the production end of the Hawaiian sugar industry, improvement in manufacturing is not allowed to become stagnant from neglect. A corps of workers under the leadership of W. R. McAllep, sugar technologist, is constantly active in experimental work in the milling processes and the analytical work connected with it and other processes which pertain to the transformation of the cane to the finished product.

Twigg Smith, illustrator, is working with several varieties of cane with a view to developing a hybrid which will possess high yielding qualities combined with the high disease resistance and remarkable vigour of the Uba variety. In this effort he is working with crosses of Uba with D1,135, Uba with H-109, and Uba with Badila. The experimental work has not been carried any further than the trial plots at the station, but if the possibilities of the hybrids developed appear great enough the work will be continued on the plantations.

Another phase of the work which Smith is conducting is a detailed morphological description of all canes for identification purposes. This work is based on the system of Dr. Jeswiet of Java.

STATION STAFF.

The experiment station staff at the present time includes the following: H. P. Agee, Director; R. C. L. Perkins, Consulting Entomologist; O. H. Swezey, entomologist; F. Muir, entomologist; C. E. Pemberton, associate entomologist; H. T. Osborne, assistant entomologist; F. X. Williams, assistant entomologist.

H. L. Lyon, in charge of botany and forestry; G. A. Mc Eldowney, forest supervisor, Oahu project; L. W. Bryan, forest supervisor, Hilo project; Donald Forbes, superintendent, Vineyard street nursery.

W. R. McAllep, sugar technologist; W. L. McCleery, associate sugar technologist; Walter E. Smith, assistant sugar technologist; A. Brodie, technical chemist; H. A. Cook, assistant chemist; R. H. King, assistant chemist; H. F. Bomonti, assistant chemist.

G. R. Stewart, chemist; W. T. McGeorge, assistant chemist; Fred. Hansson, assistant chemist; C. L. Crutchfield, assistant chemist; F. R. Van Brocklin, assistant chemist.

J. A. Verrett, agriculturist; F. A. Paris associate agriculturist; Y. Kutsunai, assistant agriculturist; H. H. Stender, assistant agriculturist; W. C. Jennings, assistant agriculturist; O. C. Markwell, assistant agriculturist; F. W. Broadbent, assistant agriculturist; Neil Webster, assistant agriculturist; Raymond Conant, assistant agriculturist; F. C. Denison, assistant agriculturist; T. K. Beveridge, assistant agriculturist.

H. A. Lee, pathologist; J. P. Martin, assistant pathologist; Clyde C. Barnum, assistant pathologist; Twigg Smith, illustrator; D. A. Meek, chief clerk; and Mabel Fraser, librarian.—Louisiana Planter and Sugar Manufacturer, Vol. LXXIII, No. 21.

TROPICAL PLANT RESEARCH FOUNDATION.

The Tropical Plant Research Foundation is an organisation formed under the auspices of the National Research Council, and incorporated under the laws of the District of Columbia for scientific and similar purposes. It has no capital stock and is not conducted for financial profit, but to advance knowledge.

The particular objects and business of this Foundation are to promote research for the advancement of knowledge of the plants and crops of the tropics; to conduct investigations in plant pathology, entomology, plant breeding, botany and forestry, horticulture and agronomy, and to publish the results thereof; and to establish and maintain such temporary or permanent stations and laboratories as may be necessary for the accomplishment of these objects, under the restrictions and regulations of its by-laws.

Some organisation such as this Foundation has long been needed in the tropics, where government agricultural departments, such as American Farmers have at their disposal, are for the most part not in existence. Tropical growers, especially Americans, have occasionally called on American investigators for assistance and advice, and, while suggestions

have been given when possible, it has been very difficult for a man hundreds of miles from the scene of operations to be of any real assistance. The best advice that can usually be given is that the applicant hire an expert to investigate the problem in question. The Tropical Plant Research Foundation now steps in to supply the needed investigators, not at a profit but at the cost of the work done, such cost to be covered by the subscriptions of those benefited. It is quite likely, by the way, that investigations made in the United States would be more highly appreciated by the agricultural public if they were conducted on the basis of subscriptions for value to be received. As it is, the work done in the United States is free, and is consequently often neglected and its potential value never fully realised.

A list of the trustees of the Foundation is a sufficient guarantee of its responsibility. These are Prof. L. R. Jones, University of Wisconsin ; Prof. Robert A.Harper, Columbia University; Dr. William Crocker, Thompson Institute for Plant Research; Prof. S. C. Prescsott, Massachusetts Institute of Technology ; Mr. V. M. Cutter, United Fruit Company ; Mr H. C. Lakin, the Cuba Company ; Major George P. Ahern, formerly Philippine Director of Forestry ; Mr. J. T. Crawley, formerly Director, Cuban Experiment Station and Porto Rico Sugar Station. Dr. William A. Orton, formerly of the United States Department of Agriculture, is Scientific Director. Besides the entomologists there are on the staff Dr. James A. Faris, pathologist ; Dr. Marion N. Walker, assistant pathologist ; Dr. R. V. Allison, chemist and soil biologist.

The Cuban sugar-cane investigation is the first piece of work to be undertaken by the Foundation, but other projects dealing with tropical crop industries are under consideration.

The co-operation with the United States Sugar Cane Insect Laboratory, the address of which is 8203 Oak Street, New Orleans, is expected to be of benefit both to the laboratory and to the entomological service of the Foundation.—Louisiana Planter and Sugar Manufacturer, Vol. LXXIII, No. 21.

ON PACKING PALM SEEDS.

It usually happens when fruits or seeds of Palms are sent home from tropical countries that they fail to germinate, yet, according to experiments* by Mr. N. Damner, if properly packed they may be sent without losing their power of germination. The author recommends packing, say, two seeds in a small lead box, about four by three-and-a-half by one-and-a-quarter inches, filling in with sawdust or charcoal and inserting one piece of unglazed moistened paper. The box should be loosely covered so as to admit air. By adopting this method he has found it possible to germinate many species of Javan Palms.—Gardeners' Chronicle, Vol. LXXVI, No. 1982.

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* Notizblott des Konigl botanischen Gardens, Berlin.

MARKET RATES.

MARKET RATES FOR SOME CEYLON PRODUCTS.

(FROM THE CEYLON CHAMBER OF COMMERCE WEEKLY PRICE CURRENT, DATED 12th JANUARY, 1925.)

NAME OF PRODUCE		CURRENT PRICE Rs. cts.	at	Rs. cts.	REMARKS
CACAO—(At Buyer's Stores)					
Estate—Finest	per cwt.	50 00	,,	55 00	
Do Medium	do	40 00	,,	45 00	
Do Common (Black)	do	20 00	,,	30 00	
CARDAMOMS					
All round parcel well bleached	per lb.	... ...	,,	... ...	
Do do medium	do	3 25	,,	3 60	
Special assortment 0 & 1 only	do	... ...	,,	... ...	
Seeds	do	3 70	,,	3 80	
Green	do	3 60	,,	3 75	
CINNAMON QUILLS—(At Buyer's Stores)					
Ordinary assortment (in bales of 100 lb. nett)	per lb.	0 85	,,	0 90	
No. 1	do	0 87	,,	0 92	
No. 2	do	0 86	,,	0 90	
No. 3	do	0 83	,,	0 88	
No. 4	do	0 79	,,	0 82	
CINNAMON CHIPS—Maradana, (At Buyer's Stores) (in bags of 56 lb. nett) per candy of 560 lb.		80 00	,,	87 50	
CITRONELLA OIL—(ex-Seller's Stores without packages) ...	per lb.	1 80	,,	2 00	
COCONUT—(Desiccated) Granulated goods (Delivered at Wharf or Buyer's Stores) ... ... Assortment: Medium 50 per cent. Fine 50 per cent. ...	per lb.	0 21	,,	0 21½	
COCONUT OIL—					
White Oil f.o.b	per ton	... ...	,,	610 00	
Ordinary Oil do	do	... ...	,,	580 00	
COPRA—					
Calpentyn — No. 1 quality per candy of 560 lb.		82 00	,,	87 25	
Estate — ,, ,,					
Ordinary quality (Maravila) — ,, ,,					
Cart Do do — ,, ,,					
FIBRES—(At Buyer's Stores)					
Coconut Bristle No. 1	per cwt.	8 00	,,	10 20	
Do No. 2	do				
Coconut Mattress No. 1	do	2 50	,,	3 00	
Do No. 2	do				
Coir yarn, Kogalla Nos. 4 to 9	do	10 00	,,	25 00	
Do Colombo Nos. 3 to 7	do				

PLUMBAGO		X. B. Rs. cts.		Rs. cts.	B. Rs. cts.		Rs. cts.	B. E. Rs. cts.		Rs. cts.
Ordinary Lumps	per ton	300 00	at	400 00	275 00	at	350 00	200 00	at	250 00
Chips	do	230 00	,,	325 00	200 00	,,	275 00	165 00	,,	225 00
Dust	do	175 00	,,	250 00	125 00	,,	175 00	75 00	,,	120 00
Do Flying	do	100 00	,,	145 00	...	,,	95 00	...	,,	65 00

ANIMAL DISEASE RETURN FOR THE MONTH ENDED 31st JANUARY, 1925.

Province, &c.	Disease	No. of Cases up to date since Jan. 1st, 1925	Fresh Cases	Recoveries	Deaths	Balance Ill	No. Shot
Western	Rinderpest	21	21	4	10	1	6
	Foot-and-mouth disease	10	10	2	—	7	1
	Anthrax	—	—	—	—	—	—
Colombo Municipality	Rinderpest	—	—	—	—	—	—
	Foot-and mouth disease	65	65				
	Anthrax	—	—				
	Rabies	1	1				
Cattle Quarantine Station	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	—	—	—	—	—	—
	Anthrax	45	45	—	—	—	—
Central	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	184	184	47	—	137	—
	Anthrax	—	—	—	—	—	—
	Hæmorrhagic Septicæmia	6	—	—	6	—	—
Southern	Rinderpest	Free					
	Foot-and-mouth disease						
	Anthrax						
Northern	Rinderpest	Free					
	Foot-and-mouth disease						
	Anthrax						
Eastern	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	34	34	—	—	34	-
	Anthrax	—	—	—	—	—	—
North-Western	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	3	3	3	—	—	—
	Anthrax	—	—	—	—	—	—
North-Central	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	175	175	38	2	135	—
	Anthrax	—	—	—	—	—	—
Uva	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	399	399	220	6	173	—
	Anthrax	—	—	—	—	—	—
Sabaragamuwa	Rinderpest	—	—	—	—	—	—
	Foot-and-mouth disease	23	23	9	—	14	—
	Anthrax	—	—	—	—	—	—

M. D. S. A. WIJAYANAYAKE,
for Acting Government Veterinary Surgeon.

METEOROLOGICAL

JANUARY, 1925.

Station	Temperature: Mean Daily Shade	Temperature: Difference from Average	Mean Humidity	Mean amount of Cloud 0=clear 10=overcast	Mean Wind Direction during Month	Daily Mean Velocity	Rainfall: Amount	Rainfall: No. of Rainy Days	Rainfall: Difference from Average
	°	°	%			Miles	Inches		Inches
Colombo Observatory	77·5	—1·7	80	5·5	N	101	3·53	12	+ 0·03
Puttalam	76·6	—0·8	82	4·6	NNE	120	7·34	14	+ 4·67
Mannar	77·6	—1·2	80	6·2	NNE	208	4·67	7	+ 1·94
Jaffna	76·8	—0·7	78	6·1	NE	79	4·72	9	+ 2·17
Trincomalee	77·9	—0·8	80	6·2	NE	185	7·09	15	+ 0·53
Batticaloa	76·9	—0·9	84	4·9	NNE	184	9·09	13	— 1·16
Hambantota	77·2	—1·2	83	5·0	ENE	252	7·50	9	+ 4·12
Galle	77·7	—0·6	85	5·7			5·26	14	+ 0·99
Ratnapura	78·6	—1·2	78	6·2	—	—	7·98	14	+ 2·65
Anu'pura	75·8	—0·7	82	6·0	—	—	6·56	13	+ 2·60
Kurunegala	76·2	—1·8	76	6·2	—	—	9·10	12	+ 5·52
Kandy	72·8	—1·7	78	6·8	—	—	8·74	15	+ 3·57
Badulla	69·0	—1·2	82	6·6	—	—	12·54	15	+ 2·90
Diyatalawa	63·7	—0·9	76	6·9	—	—	7·73	14	+ 1·65
Hakgala	57·0	0	86	7·1	—	—	16·09	17	+ 6·50
N.' Eliya	56·8	—0·6	76	6·0	—	—	12·10	15	+ 6·49

The total rainfall of January was well above average over the greater part of the island, and occurred chiefly during the first half of the month. On the 3rd several stations recorded over 5 inches but the wettest days were the 10th and 11th when a depression existed whose centre was south of the island, and general course westerly. Nilloomally 8·49 inches on the 10th, and Maturata 8·05 on the 11th, head the list for a single day's fall but Dooroomadella with 17·33 inches for the three days 9th to 11th inclusive and 35·52 for the month is worthy of mention, as is Uva Estate, Madulsima, whose total of 34·23 for the month included over 20 inches in the five days 9th to 13th inclusive. The main area that failed to record its average was the southern half of the eastern province, though slight deficits were also noted at a number of inland stations in the south-western quadrant and immediately south of the main hill country e.g., Hiniduma, Carney, Rasagalla and Haldummulla. One or two stations in the North were also not quite up to their average but as they were chiefly new stations their averages are not yet very well determined.

The mean Humidity and Wind Velocity worked out to about normal for the month as a whole, though the depression referred to above was responsible for some rough weather about the 10th and 11th, and in particular its aftermath included some local whirls on the afternoon of the 14th, which, though confined to small areas, were intense enough to do considerable damage in those areas—notably in the neighbourhood of Hikkaduwa and slightly south of Mt. Lavinia.

Pressure and Mean Temperature were both below normal, the latter result was obtained chiefly on account of low night temperatures in the second half of the month.

A. J. BAMFORD,